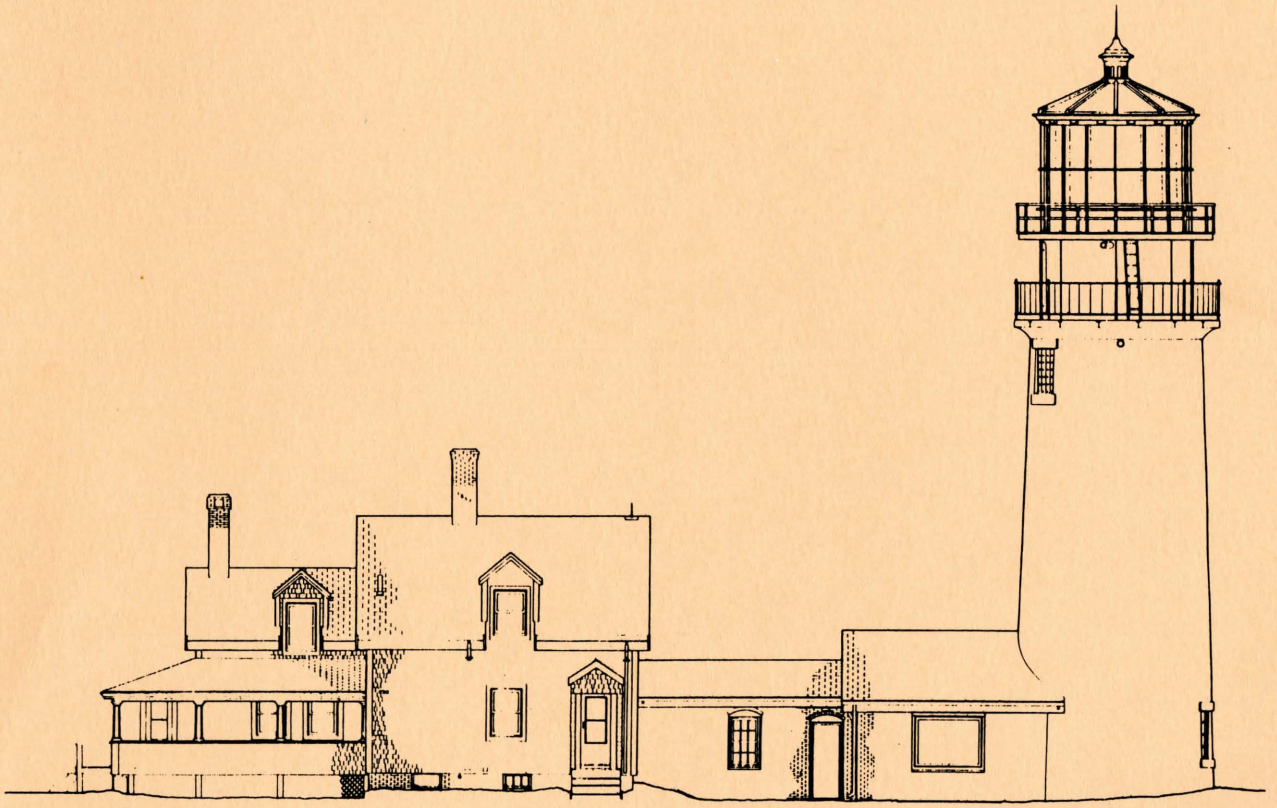
HIGHLAND LIGHT

Cape Cod
Massachusetts



Historic Structure Report

HIGHLAND LIGHTHOUSE AND KEEPER'S DWELLING

HISTORIC STRUCTURE REPORT

North Truro, Massachusetts

Completed in Conjunction with the
United States Coast Guard

Prepared by

The Building Conservation Branch, Cultural Resources Center
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EXECUTIVE SUMMARY

The Highland Lighthouse complex, located in North Truro, Cape Cod, MA, is owned and operated by the United States Coast Guard. The lighthouse tower and unmanned beacon provide an aid to navigation, while the two other remaining primary structures on the property provide housing for Coast Guard families. One dwelling, which is connected to the tower by a series of two smaller structures, dates to the construction of the extant light tower (1856-57). The other structure, a duplex ranch-style house, was completed in 1963. The majority of structures once associated with the site have long since disappeared, most often demolished by the hand of man, but sometimes by the hand of nature.

Erosion of the adjacent cliffs, once called the "Clay Pounds," is constantly reducing the original size of the site. This reduction has prompted many concerned citizens, both private and public, to campaign for saving the lighthouse and its attached Keeper's Dwelling. (The duplex dwelling is not historic). The immediate result of this campaign is that the Coast Guard was directed by Congress to fulfill all regulatory requirements in preparation for the relocation of these historic structures, which are listed in the National Register of Historic Places.

This report was prepared in fulfillment of the Section-106 compliance process, which is required before federal funds can be expended on projects that might impact the condition or integrity of National Register properties. Since federal funds would be appropriated to relocate the lighthouse and keeper's dwelling, complete documentation both archival and physical is required. This is accomplished in the form of this historic structure report.

In some respects, this report became a collaborative effort between the U.S. Coast Guard and the National Park Service. In many cases the Coast Guard was the supplier of documents and other archival material needed to understand the history of the site and its structures. It also provided complete access to the structures so that a physical investigation could be completed, in spite of the fact that a Coast Guard family was residing in the Keeper's Dwelling.

The research conducted for this report was thorough; a large number of institutions and repositories were consulted for related documents. Within the Coast Guard's organization, valuable archival information came from the U.S. Coast Guard Historian's Office in Washington, D.C.; the Civil Engineering Unit Providence, located in Warwick, RI; and the U.S. Coast Guard Academy Library, New London, CT. The Coast Guard's Woods Hole Group Office on Cape Cod also was contacted for information relating to the site.

The Boston Public Library's Microtext and Government Records Sections, the American Antiquarian Society, the Massachusetts Historical Society, and the Massachusetts State Library's Special Collections Branch—all located in Boston—had archival deposits that were extremely useful for specific research. Cape Cod repositories included the Sturgis Library, the Cape Cod Community College Library, and the Barnstable County Hall of Records, all located in Barnstable; the Snow Library in Orleans; the Provincetown Public Library; the Truro Public Library; the Wellfleet Public Library; and the Cape Cod National Seashore's library. The United States Lighthouse Society in

San Francisco, CA, also forwarded information compiled from their extensive collection of *Light Lists*.

The National Archives—both their main facility in Washington, D.C., and their branch in Waltham, MA—held the bulk of the primary documentation pertaining to the earlier history of the site and administration of lighthouses. However, several archivists have surmised that the majority of the records from the 1850's and specific to the Highland site were lost in a fire. While references to documents written during that time period have survived, the majority of actual documents have not. The National Archives' Cartographic and Architectural Branch had no plans or drawings related to the site. The National Archives' Photographic Branch is closed for renovation, but it is believed that all of the historic photographs related to the site that are part of the Archives' collection were acquired from other institutions' collections. Historic photographs were obtained from the U.S. Coast Guard Historian's Office; The Library of Congress, Historic American Building Survey Collection, Washington, D.C.; The Society for the Preservation of New England Antiquities in Boston; the Mystic Seaport Museum, Inc., in Mystic, CT; the Peabody Essex Museum in Salem, MA; and the Building Conservation Branch's own collection in Lowell, MA. Finally, the majority of historic photographs were found in the curatorial collection of Cape Cod National Seashore, National Park Service, Eastham, MA.

The research connected with this report produced specific evidence for the construction of three different lighthouses within the same property boundaries, in what is now called North Truro, Cape Cod. The first was built in 1797, the second circa 1831, and the third and present structure—including the keeper's dwelling—in 1856-1857. In order to be preserved, the lighthouse tower and dwelling need to be relocated away from the eroding cliffs at their eastern boundary. Since the tower's beacon is to continue in the same capacity as an aid to navigation, the relocation site must be near the shoreline.

This report documents historically and physically the lighthouse tower, the two small connecting structures, and the keeper's dwelling. All four structures are connected. A duplex assistant keepers' dwelling that was constructed in 1857 was also connected, but was demolished circa 1961 to provide space for the extant housing duplex.

The four connected structures will be relocated to adjacent property administered by the Cape Cod National Seashore. The relocation should retain the same integrity of their orientation and connections to one another. Consideration should be given to the landscape siting and vista provided by the approach to the new location: while neither can be duplicated within the area selected for relocation, both contribute to the site's character-defining features. The tower will remain as an unmanned aid to navigation, and therefore will require space for supporting equipment. It is recommended that the small connecting structure immediately adjacent to the tower be retained as an equipment room, which is the same use it currently serves. Specific recommendations for treatment will be provided after the period of significance and use of the keeper's dwelling have been determined. These will be included in this historic structure report as an addendum.

ADMINISTRATIVE DATA

Originally, Highland Light was known as Cape Cod Light. Locals often referred to the site in the 19th century as the "High Land." An early 20th-century photograph exhibits a sign in front of the station that is partially obscured, but appears to bear the name "Highland." However, the official change in Cape Cod Light's name was not noted until the Annual Report of 1976, when the record showed that the name was changed to Highland LTSTA (lightstation).

Some confusion may have occurred early in the 19th century as more lighthouses were constructed on Cape Cod, and the use of "Highland" may have distinguished the site from other Cape Cod lighthouses. Both names were used interchangeably, but the exact date when this became common practice is unknown. The majority of official historical correspondence refers to the site as "Cape Cod," but references can also be found for "Highland." The use of both names may add confusion to this report: when one name was found in a historical reference, it was repeated in this document whether or not it was officially accurate. An attempt was made to use the official name of the station in contemporary references; however, this may not have been accomplished universally, since the researchers came to accept both names without question, and since the most modern nomenclature is accepted as "Highland." If an apology to the reader is required for this confusion, it is extended now. However, it is hoped that the reader will appreciate the ease of interchanging "Cape Cod Light" with "Highland Light" throughout the text, as the authors began to appreciate it while writing their assigned sections.

Highland Light is currently administered primarily by Group Woods Hole (MA). The U.S. Coast Guard's First District Office, headquartered in Boston, MA, has authority over aids to navigation issues, and the Civil Engineering Unit Providence (RI) is responsible for real property management. This administration has changed radically throughout the history of the lighthouse service, as this report will show.

Highland Light Station is located at the east end of Highland Road in North Truro, perched at the top of eroding clay cliffs. The lighthouse tower, keeper's dwelling, and connecting structures will be relocated to a site less susceptible to the dangers of the eroding cliffs. A recommendation as to the exact location of that new site is beyond the scope of this report. The tower is to remain as an unmanned aid to navigation, while its small connecting structure should be retained as a support space to house equipment. The keeper's dwelling should also be reused in order to assure maintenance, but a recommendation for a specific reuse is again beyond the scope of this report.

In 1970, a Development Concept Plan was prepared by the National Park Service regarding Highland Light. Since the relocation of the lighthouse was not a concern at that time, this plan is outdated. A "Preliminary Resource Assessment" for Highland Light was published in September 1992, recommending that the Coast Guard and National Park Service jointly develop a strategy for the light's relocation. A planning study and this historic structure report are a result of the assessment's recommendation.

The initial product of the Highland Light Relocation Planning Study was a draft document entitled "Relocation Alternatives Report," completed in April 1994 by a consortium of professionals. This group consisted of Goody, Clancy & Associates, Inc., Architects and Planners; Carol R. Johnson Associates, Inc., Landscape Architects; Shary Page Berg, Landscape Specialist; Ray, Spofford & Thorndike, Inc., Civil Engineers; and UMass Archaeological Services, Archaeologists.

Highland Light is listed in the National Register of Historic Places as part of the Lighthouses of Massachusetts, Thematic Group Nomination. The period of significance for the thematic study was designated as 1679 to 1940, with significant context attributed to architecture, engineering, maritime history, and transportation. The nomination was accepted by the Keeper of the Register on June 15, 1987. After their relocation, the four connected Highland Light structures will be treated as a rehabilitation.

The investigation for this historic structure report produced a variety of documents. All of the research materials, measured drawings (originals), and samples collected for materials analysis are filed and stored at the Building Conservation Branch, Cultural Resources Center, in Lowell, MA. In addition to copies of the final historic structure report, a full-size set of reproducible measured drawings will be forwarded to the U.S. Coast Guard's Civil Engineering Unit Providence, located in Warwick, RI. Any of these materials are available for inspection or future research at any time upon request.

I. HISTORY OF DEVELOPMENT AND USE

STATEMENT OF SIGNIFICANCE

The Highland Light is of historical significance both individually and representationally. The first Highland Light, called the Cape Cod Light, was one of the early major lighthouses on the east coast. The light also appears to have been outfitted with the first eclipsing mechanism used in the United States. In addition, the history of that light and its two successors clearly reflects many of the larger trends and controversies that have defined the history of the lighthouse service itself. Whether the issue is lighthouse site selection, contracting, construction, rebuilding, outfitting, or operating, Highland Light is broadly representative of lighthouses along the North Atlantic coast.

The present lighthouse is also significant as a scenic local landmark. This fact has prompted the current campaign to save it from collapse due to erosion, by moving it to a new site. It is worth noting that this effort to relocate a masonry lighthouse tower is largely without historical precedent. An exhaustive analysis on the subject of moving lighthouses is beyond the scope of this report. However, the secondary literature contains accounts of what happened when a lighthouse had to be replaced due either to functional inadequacy or danger from erosion. Most often, a new structure was erected on, or as close as feasible to, the site of its predecessor, with a temporary beacon being used to avoid an interruption in lighting. The literature indicates that the practice of moving an existing structure was relatively rare among the earliest wooden lighthouses. One of the few such was the wooden tower at Cape Poge on Martha's Vineyard, which was moved back from the sea in 1838 due to erosion.[1] There is no known historical instance of moving a masonry tower. Relocation was more common among the cast-iron lighthouses, and the occasional wooden lighthouse, used after the Civil War, which were intended to be moved. A case in point is the Three Sisters lighthouses at Nauset (Eastham, MA). The three original towers were built of brick in 1838. When they needed to be replaced in 1892, new movable wooden towers were built farther back from the sea, and the old brick towers were allowed to succumb to erosion.[2] In 1911, improved technology allowed two of the three wooden towers to be taken out of service. These were later moved away. The third was retained and moved back from the water. This tower was itself replaced in 1923 by the present cast-iron tower. (The latter was one of two that had been built in Chatham, but it was later declared surplus and made available for reuse.)

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[1] Edward Rowe Snow, *The Lighthouses of New England* (New York: Dodd, Mead, 1973), p. 292.

[2] Annual Report of the Lighthouse Board to the Secretary of the Treasury for the Fiscal Year Ended June 30, 1892 (Washington, D.C.: Government Printing Office, 1892), p. 55.

THE FIRST CAPE COD LIGHT

Administrative Background

Even in Colonial times, Massachusetts was a leader in the establishment of lighthouses. Given the economic importance of its maritime activities, the enterprising reputation of its citizens, and the hazards of navigation along its coasts, the interest in marine safety is not surprising. The first lighthouse in the future United States, probably the first in the Western Hemisphere, was illuminated on Little Brewster (Lighthouse) Island at the entrance to Boston harbor in 1716. Of 15 lighthouses in operation or undertaken at the time the federal government was organized in 1789, seven were in Massachusetts (which then included Maine).[1]

When Massachusetts transferred custody of its lighthouses to the federal government in 1790, it represented a significant expression of confidence in the new national government. Massachusetts apparently regarded its concession as something of an experiment, for the legislation contained a provision that "if the United States shall at any time hereafter neglect to keep lighted, and in repair, any one or more of the lighthouses aforesaid, that then the grant of such lighthouse . . . shall be void and of no effect."[2] During the 1790's the federal government gradually assumed operation of existing lighthouses, completed several that had been initiated by the states, and erected new ones. Administration of lighthouses became an accepted federal responsibility, located within the Treasury Department. (With the State Department as the only other civilian cabinet department, the choice was limited).

Local interests retained a significant voice in issues relating to lighthouses. In its early years, the federal lighthouse establishment operated without any overall plan or assessment of needs. Although attempting some standardization of practice, it was responsive to local pressures expressed through Congress. Lighthouse affairs received high-level attention in the infancy of the federal government. It was normal procedure for a member of Congress to introduce bills to establish lighthouses and for the President or Secretary of the Treasury to personally approve nominations of lighthouse keepers and contracts for building lighthouses.[3] Cape Cod Light was established under

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[1] Compiled from information in *America's Lighthouses* by Francis Ross Holland, Jr. (Brattleboro, VT: The Stephen Greene Press, 1972), and Malcolm F. Willoughby, *Lighthouses of New England* (Boston: T.O. Metcalf, 1929).

[2] June 10, 1790; Box 86; Lighthouse Site Files, 1790-1939 (Site Files); U.S. Coast Guard Lighthouse Service, Record Group 26 (RG 26); National Archives, Washington, D.C. (NA/DC).

[3] The expense of the lighthouse establishment was perhaps a more visible component of the federal budget than it became later, although even in 1789 the total cost of supporting the entire lighthouse establishment was only $37,161.

these conditions, in which lights were approved on an individual basis due largely to the representation of private interests.

The Need for the First Light

The antecedents of the present Highland Light can be traced at least to 1792. On February 6 of that year, the Humane Society of the Commonwealth of Massachusetts resolved:

> That the President, the Vice-President, Treasurer, and Corresponding Secretary be a committee to wait upon His Excellency the Governor and request him to represent to such officers of the government as he may think proper, the necessity of having a Light House erected on some part of Cape Cod, in order to preserve the lives and property of those who navigate the Bay of Massachusetts; and to desire that such Light House may be erected at the charge of the Continent.[4]

The Humane Society had been formed in Boston in 1785, modeled on a similar British organization. It was joined in this request by the Boston Marine Society, and committees of the two organizations presented petitions to the governor.[5]

The theme was renewed by the Massachusetts Historical Society in a 1794 publication. In a description of Truro, one of an occasional series about towns in the Commonwealth, it was noted that:

> The eastern shore of Truro is very dangerous for seamen. More vessels are cast away here than in any other part of the county of Barnstable. A light house near the Clay Pounds, should Congress think proper to erect one, would prevent many of these fatal accidents.[6]

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[4] Quoted in M.A. DeWolfe Howe, *The Humane Society of the Commonwealth of Massachusetts: An Historical Review 1785-1916* (Boston: Humane Society, 1918), p. 89.

[5] William A. Baker, *A History of the Boston Marine Society, 1742-1967* (Boston: Boston Marine Society, 1968), p. 73.

[6] "A Topographical Description of Truro," *Collections of the Massachusetts Historical Society*, First Series, Vol. III, 1794, p. 197.

The author was not identified, but the article may have been written by Rev. James Freeman, who was one of the founding members of the Humane Society. Rev. Freeman, then minister of the Stone Chapel in Boston, was a Truro native.

These representations are significant in several respects. On one level, they are typical of the process by which agitation for new lighthouses arose. More importantly, they make it clear that the initiative came from Boston, so that the Cape Cod Light was and has remained in essence an outlying light of Boston. By land the journey was long and tiresome, but by water the tip of Cape Cod is less than 50 miles from Long Wharf. Cape Cod and Cape Ann mark the limits of Massachusetts Bay, and the lighthouses on the Highlands and on Thatcher's Island off Cape Ann are the sentinels that guard the entrance to the bay. The light on Thatcher's Island, originally established in 1771, predates that on Cape Cod.[7] Many Cape Cod mariners would have benefited from lights on their dangerous native shores, but they were not strong or well-organized enough to make their wants felt. Only Boston interests were capable of exerting sufficient pressure.

Advocating lights beyond the immediate limits of one's own harbor was by no means unprecedented. In the case of Cape Cod, the light—though distant—was within the same state. Sandy Hook Light in New Jersey, erected in 1764 and now the oldest lighthouse tower in the United States, was built through the efforts of New York City merchants.[8] Shortly afterward, Cape Henlopen Light was erected at the entrance to Delaware Bay at the behest of Philadelphia commercial interests. Here the land on which the lighthouse was situated, though located in Delaware, was owned by Philadelphia commissioners.[9]

An even more far-reaching example of locating lighthouses beyond one's immediate jurisdiction almost occurred in 1788, when the Humane Society advocated building a lighthouse and possibly supporting a small settlement on Sable Island, off the south coast of Nova Scotia. This island belonged to Great Britain, although Massachusetts Governor John Hancock apparently owned most of it. In a message to the state legislature on November 10, 1788, Hancock went on record as supporting the idea. Not considering foreign ownership an insurmountable obstacle, he wrote that "it would be of the greatest utility to place a Light House, and a few families there."[10]

When it became apparent that the indirect approaches through the governor had not produced the desired results, the Marine Society renewed its efforts. This distinctive and prestigious

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[7] The name is also spelled Thacher's. Coast Guard records show 1771 as the date of construction for Thatcher's Island Light. Holland also says that it was built in 1771. George R. Putnam (*Lighthouses and Lightships of the United States* (Boston: Houghton Mifflin, 1917) gives the date as 1789, but his seems to be in error.

[8] Holland, p. 11. New York's interest may have extended beyond building the Sandy Hook light to actual ownership. A compilation in the Lighthouse Annual Report dated April 14, 1800, states that the light was "ceded by New-York, being the property of that state" on February 3, 1790.

[9] Box 86; Site Files; RG 26; NA/DC.

[10] Quoted in Howe, p. 87.

organization had been founded in 1742, making it the oldest in America, perhaps the world. Composed largely of active and retired shipowners and sea captains, it combined the functions of social club, mutual aid society, information exchange, and lobbying forum. In February 1796 this body, after consultation with the Humane Society and with the Chamber of Commerce and the Marine Society of Salem, sent a petition for a lighthouse on Cape Cod directly to the Congress in Philadelphia.[11]

The campaign to establish a light on Cape Cod culminated on May 17, 1796, when Congress approved a bill for this purpose. Another necessary step in the process of establishing the light took place on June 18, 1796, when Massachusetts passed legislation to cede jurisdiction to the United States of land for the lighthouses at Cape Cod and Baker's Island, at the approach to Salem.[12] The amount of land was limited to 10 acres in each case. This figure represented a compromise between the prevailing reluctance to grant the federal government too much control within the states, and the desire to permit lighthouse keepers to earn a portion of their livelihood by farming. It was felt that on 10 acres a keeper could provide some of his subsistence, thereby justifying a lower salary. During this period, cessions of Massachusetts land for lighthouse purposes ranged from four to 12 acres, with 10 acres close to the median.[13]

Site Selection

General Location

Winning approval for a lighthouse was an essential part of the process, but it had to be followed by selection and acquisition of a site. This was relatively simple in the case of lights at harbor entrances or on isolated rocks, like many in Maine. For those lights later classified as coastal, which marked large geographical features, there was more latitude for choice. No written instructions on siting existed, but accepted procedures had grown up. As the early correspondence indicates, the proponents of the Cape Cod Light assumed that the preferred location would be on the Highlands or Clay Pounds (Clay Ponds) of North Truro. Here the height of the cliffs facing the

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[11] Baker, p. 73. In addition to assisting in the campaign for a light on Cape Cod, the Salem Marine Society continued to press for a light on Baker's Island and was ultimately successful [Snow, *The Lighthouses of New England* (New York: Dodd, Mead, 1973), p. 149.]

[12] Site Files; RG 26; NA/DC.

[13] Site Files; RG 26; NA/DC. Other cessions in Massachusetts during this period include: Seguin Island (Maine)—10 acres; Gay Head—4 acres; Gloucester—7 acres; Cape Poge—4 acres; White Head Island (Penobscot Bay, Maine)—10 acres; Chatham Harbor—12 acres,; Franklin Island (Maine)—12 acres; Scituate—6 acres.

ocean meant that a relatively low—and therefore inexpensive—structure could support a lantern that would be visible at a great distance.[14]

Beyond this general assumption, there were no specific instructions as to where to place the light, nor was there a formal system for selecting a site. In the 1790's, lighthouse affairs within the Treasury Department were administered by the Commissioner of Revenue, Tench Coxe. He relied heavily on the collectors of the various ports, who also held the title of superintendent of lighthouses in their districts. There were 11 such superintendents in 1792.[15] In Boston this post was held for many years by General Benjamin Lincoln (1733-1810), presumably as a reward for his services in the War for Independence, and for crushing Shays' Rebellion in 1787, a campaign ardently supported by the Boston mercantile interests. Lincoln was directly responsible for far more lighthouses than any other superintendent. In 1800, for example, there were 25 lighthouses in the United States, of which 13 were in Massachusetts and 11 were supervised by Lincoln.[16]

In June 1796, immediately after being notified of the act to establish the Cape Cod Light, Coxe solicited advice about locating it from both Lincoln and Rep. Nathaniel Freeman of Plymouth, the sponsor of the legislation. In his letter to Rep. Freeman, Coxe observed that "Local knowledge and previous consideration may have led to results which will promote economy or increase the utility of the building."[17] These letters indicate that Coxe had no preconceived ideas about the precise location of the light or the dimensions of the building. Likewise, there is no indication that Lincoln had definite ideas or information on the subject.

Coxe's letter to Lincoln, however, contains an informative summary of the general considerations that influenced the choice of lighthouse sites. Among these factors he listed "The nature of the soil for the Foundation, for fresh water, for gardening, pasturage and farming, and for fuel, the distance of the five nearest families, the necessity of a dwelling house and oil vault. . . ." He also stressed that the elevation of the site was "of great consequence" and should be "accurately ascertained by an instrument."[18] Except for that, it is interesting to note that the factors cited were

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[14] It is important to keep in mind that during the period in question, Cape Cod was generally defined as the tip of the cape, comprising present Provincetown and North Truro. This is unlike the current usage, in which Cape Cod is largely synonymous with Barnstable County.

[15] Willoughby, p. 17.

[16] These figures include a light on Nantucket that was classified as a beacon. [Lighthouse Annual Report, 1800; roll 2, microfilm M63 (M63/2); Lighthouse Letters (LH Letters); RG 26; National Archives—New England Region, Waltham, MA (NA/MA).

[17] Tench Coxe, Commissioner of Revenue, to Rep. Nathaniel Freeman, June 9, 1796; Letters Received by the Boston Collector (Letters BC); Correspondence, Series 17 (Correspondence); RG 26; NA/MA.

[18] Coxe to Gen. Benjamin Lincoln, Boston Collector, June 11, 1796; Letters BC; Correspondence; RG 26; NA/MA. The reason for concern about the nearest families was not explained. Presumably the nearness of other people would make it easier for the keeper to obtain supplies and assistance, especially in an emergency.

all land-based, having to do with the support of the keeper. Another concern, though not noted specifically with reference to Cape Cod, was the cost of carting, which was liable to be considerable in constructing lighthouses at isolated locations.[19]

At that time, with the federal government under chronically severe financial constraints, every effort was made to control expenses of the lighthouse establishment. If money could be saved on land purchases and the construction of auxiliary buildings, more of the appropriation could be devoted to the lighthouse itself—as Coxe noted. If local conditions permitted the keeper to provide some of his food, then a lower salary could be justified. This was especially true at remote locations, which many lighthouses were by their very nature.

In transmitting a copy of the state legislation to Lincoln on July 8, 1796, Coxe requested him to take "immediate measures" to procure the full amount of ten acres by "gift or purchase." Ever cost-conscious, Coxe explained "I say by gift, because it is possible that the sandy nature of the land at Cape-Cod may render it of as little value as that of other sites, which have been granted for only a formal consideration."[20]

Coxe added that Lincoln should "have the best spots carefully fixed on and endeavor to obtain each of the lots, upon the most favorable terms. . . ." This indicates that he had received no useful responses to his earlier inquiries and had developed no further ideas on the specific location of the Cape Cod Light. If Lincoln had thought further on the subject, he had apparently not communicated his findings to Coxe.

From his bases in Boston and Hingham, Gen. Lincoln had ready access to information and opinions of mariners on the subject of lighthouses—perhaps more ready than he sometimes wished. He personally owned a schooner that often sailed to Maine, where he—like his colleague General Henry Knox—possessed vast landholdings.[21] Lincoln could also draw on the experience of the Boston Marine Society, which had granted him an honorary membership soon after he assumed the post of collector. In later correspondence, Lincoln informed Coxe that "our marine society is composed not only of old masters of vessels, but of those who are now masters, and more information is I think to be collected from them . . . than from any other source."[22]

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[19] This is stated explicitly by Coxe in a letter the following year concerning the lighthouse at Cape Hatteras, NC. Writing to Henry Dearborn, a potential contractor, he observed "The article of carting is put upon the footing you proposed. The island or long chain of Sand Hills is understood to be about two or three miles wide. A place half a mile from the Sea at the widest part would therefore be 2 1/2 miles from the Sound. If the landing should be equally good on the outside, there will be little carting and not much at most." [Coxe to Dearborn, September 29, 1797; p. 493; roll 1, microfilm M63 (M63/1); LH Letters; RG 26; NA/MA.

[20] Coxe to Lincoln, July 8, 1796; p. 314; M63/1; LH Letters; RG 26; NA/MA.

[21] Guide to microfilm of Benjamin Lincoln Papers (BL Papers); Massachusetts Historical Society, Boston, MA (MHS).

[22] Lincoln to Coxe, December 7, 1796; microfilm roll 9 (M9); BL Papers; MHS.

Lincoln was also a founding member of the Humane Society, which shared responsibility for arousing interest in the light. The society had taken an interest in the outer Cape because of the hazard it represented to seamen. It had established a "hut of refuge" near Stout's Creek in 1792, the fifth in a series of huts on desolate shores initiated in 1787.[23] This focus on the Cape culminated in the publication of a pamphlet entitled "A Description of the Eastern Coast of the County of Barnstable from Cape Cod, or Race Point, to Cape Malebarre, or the Sandy Point of Chatham" in 1802. The pamphlet, written by Rev. Freeman, was printed in 2,000 copies and distributed to customs houses and insurance offices.[24] The information amassed by the Humane Society in its several years of involvement with Cape Cod would have been freely accessible to Lincoln in considering the site of the new lighthouse.

Finally, armed with Coxe's explicit instructions, Lincoln took direct action and journeyed to Cape Cod himself, accompanied by several "marine gentlemen." On the Cape he was joined by "gentlemen of that country," noting that Provincetown people owned "30 sail."[25] The Provincetown interests might not have been influential enough to generate a movement for a lighthouse, but they were happy to contribute to an initiative that had originated elsewhere.

"To say that a light-house should be built on Cape Cod was as indefinite as it would be to say that a light-house should be erected on the Delaware," and Lincoln feared a "diversity of opinion" about the location. He was therefore gratified to find complete unanimity among his advisers, whether from Boston or Cape Cod, as to a location at the "Clay Pounds" of Truro. In his report to Coxe, he recited the nautical considerations that led to their consensus:

> They were induced to adopt this opinion from the heighth of the land, being one hundred and fifty feet above the highwater mark. Because vessels coming in from sea attempt to make high land. Because it has a bold shore. Because here is the greatest projection of the land eastward and a vessel off one league from the land may shape her course for Boston lights

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[23] Annual Reports of the Humane Society; MHS. It is not certain whether this site was within the present limits of Truro or Provincetown. Stout's Creek was a familiar location in the 1790's, but has not been found on later maps. It is one of the transient features of Cape Cod, for even in 1802 Rev. James Freeman wrote "Many years ago there was a body of salt marsh on it, and it then deserved the name of a creek. But the marsh was long since destroyed; and the creek now scarcely exists, appearing only like a small depression in the sand, and being entirely dry at half tide." ["A Description of the Eastern Coast of the County of Barnstable, from Cape Cod, or Race Point...to Cape Malebarre, or the Sandy Point of Chatham . . ." (Boston Humane Society, 1802), p. 6.]

[24] Howe, p. 197. In addition to printing in pamphlet form, the "Description" appeared in *Collections* of the Massachusetts Historical Society, First Series, Vol. VIII, pp. 110-119. Freeman's authorship of this pamphlet is an additional reason for suspecting that he was responsible for the 1794 "Topographical Description" of Truro.

[25] Lincoln to Coxe, July 26, 1796; M9; BL Papers; MHS.

> or for entering the shoals of Nantucket without a hazard of being taken up by any shoals whatever.[26]

Within the area of the Clay Pounds, Lincoln had to select a specific piece of land on which to build the lighthouse. In this, too, he acted decisively and chose a site during his visit. Under a deed signed August 6, 1796, the government acquired the authorized 10 acres "near a place called the Clay Ponds" in Truro from Isaac Small of that town.[27] This was a critical decision in the history of the Cape Cod Light, for it established the lighthouse on land that it and its successors have occupied ever since.

Lincoln diplomatically referred to Coxe's letter of June 9, 1796, in describing the considerations that influenced his choice of a site:

> Because here the lands are pretty good and are not so sandy as to be liable to be blown away by the high gales of wind too often experienced on this Cape. Because the Peninsula is but about one mile wide and on the west shores thereof all the materials may be landed and carted in a good road across.
>
> As the light-house must be of wood the soil will be good for its foundation. . . . Fresh water can easily be obtained within the ten acres. The land will summer a cow after a garden shall be taken off for which there is some pretty good land. The flock is wintered there by salt hay. The fuel must be purchased from the inhabitants possessing the southerly part of the Town or from coasting vessels which frequently call there.
>
> The five nearest families are about one fourth of a mile from the ground on which probably the light-house will stand.[28]

Lincoln purchased the land at a price of $110. Coxe seems not to have commented on the fact that this land cost the government $110, not the "little or nothing" he had hoped for in his letter of July 8, 1796. Lincoln, however, must have felt some trepidation about his supervisor's response, for he explained that a direct purchase was preferable to going through condemnation proceedings. He pointed out that the Barnstable court house was 40 miles distant and implied that commissioners who would be appointed under such proceedings might not come up with a result much different.

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[26] See footnote 25. Lincoln's figure of 150 feet for the height of the area offers grounds for interesting speculation. The same height is given in the sailing directions prepared by the Marine Society just before the lighthouse went into service, but this figure is approximately 20 feet greater than the highest point in the present lighthouse reservation. It is possible that portions of the land that have since eroded were higher. Alternatively, and more likely, the number given by Lincoln was a guess, not a measurement.

[27] Barnstable County Registry of Deeds (Deeds), book 49, p. 95.

[28] Lincoln to Coxe, July 26, 1796; M9; BL Papers; MHS. In a postscript, Lincoln listed the families as Widow Eldredge, Wd [Widow?] Snow, John Avery, Joseph Barry, and Isaac Small.

Small apparently conveyed all the ocean frontage he owned in that vicinity, since the tract was bounded by abutters on both the north and south. This indicates that he attached little value to access to the ocean; also, he did not retain a right of passage across the government land, although the government acquired such right from him.[29]

The figure of $110 was based on an allowance of $100 for the land and another $10 for the "right of passing" across Small's property to reach the lighthouse.[30] This clause provides additional confirmation, if any is needed, that the road to the lighthouse owes its existence to the lighthouse. There is no evidence that such a road existed before the building of the lighthouse, nor would there have been any discernible reason for one. Whether the road has always followed essentially the course of the present road, allowing for a greater length if the lighthouse was once located farther to the east, is more problematical. The main highway now known as South Highland Road cannot have been changed much in this vicinity, since an existing house on it predates the lighthouse and another is nearly as old.[31] If a road leading from the main road to the lighthouse had been laid out much farther north, it would have lost the advantage of the high ground; farther south would have increased its length unnecessarily.

The issue of siting demands consideration because the location chosen, while elevated, is by no means the highest land in the vicinity. Within 2 to 3 miles to the south, elevations 20 or more feet higher are found. Due to the inherent limitations of lighting apparatus of the time, there may have been no significant advantage in raising the light another 20 feet. However, the prospect of contracting for a tower 20 feet lower presumably would have been appealing to the tight-fisted Treasury officials.[32]

There appear to have been several reasons for selecting Isaac Small's land over other parcels. First, Lincoln was pleased that, after taking all of Small's ocean frontage as one boundary and going

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[29] Other deeds from the period indicate that Small owned or had improved adjacent land to the south, and it is quite certain that he owned other tracts fronting on the ocean. The land records are more confusing than usual, for in addition to the customary problems with indefinite descriptions, many Barnstable County records were destroyed in a fire in 1827. Surviving records make it apparent, however, that lands on which salt hay could be cut were considered to be of greater value than land facing the Atlantic, or "back side sea" as it was often termed.

[30] Lincoln to Coxe, July 26, 1796; M9; BL Papers; MHS.

[31] These are the Isaac Small house, believed to have been constructed in the 1780's, and the Thomas Kenney Small house, which appears to have been constructed circa 1820-1830. [Inventory forms at the Massachusetts Historical Commission.] An unimproved road to the lighthouse is shown in the 1831 John G. Hales Plan of Truro [Massachusetts State Archives].

[32] A countervailing consideration is the fact that lighthouses also served as daymarks, which is one reason why most of them were painted white. A structure more squat than that actually built at Cape Cod might have been of little value for this purpose.

inland enough to encompass 10 acres, the parcel "will form nearly a square."[33] This was not literally accurate, but is a reasonable approximation. The 1885 E.P. Adams survey (see fig. 10), the earliest that has been found that gives specific measurements for the site, shows a land boundary on the west of 760.5 feet. The dimensions on the south and north are calculated as being 708 feet and 448 feet, respectively. Presumably this was done by extrapolation, measuring from the existing cliff edge to points then under water except perhaps at extremely low tide.[34]

Another reason may have been related to Isaac Small himself. Keeping in mind the general considerations in siting a lighthouse that Coxe had listed in his letter of June 11, 1796, the advantages presented by Small were difficult to overlook. He was already a resident of the area, supporting himself largely by agriculture, so that if he were appointed keeper he would not have to depend exclusively on a government salary. Nor would an exceptional dwelling house be required. This part of Small's land, consisting of the unusual clay deposits, was rich by Truro standards. A later historian of Truro described it as "uniformly the best land in town, perhaps originally in the county."[35] The surviving Indian name for the area, "Tashmuit," supposedly meant "place of many springs," indicating that water supply would not be a problem.[36]

There may have been an understanding that in return for conveying land to the government on reasonable terms, Isaac Small would be appointed keeper of the light. The practice of land grantors being hired as Keepers is found repeatedly throughout lighthouse history, especially in New England.[37] At the Gurnet Point Light in Plymouth, MA—first built in colonial times—the man on whose land it was situated became keeper. Under federal administration, the light (one of those within Lincoln's district) continued to be kept by the widow of the original keeper.[38]

An arrangement with Small offered still other savings. Less fencing than usual would be needed, since the longest land boundary of the lighthouse tract adjoined Small's remaining land. Even a detailed survey could be avoided. Small's deed was bounded by abutters on the north and south sides and on the west simply came in sufficiently from the high water mark to enclose 10 acres. With Lincoln and the other superintendents under relentless pressure from Coxe to restrain the expense of the lighthouse establishment, these savings would have been appealing.

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[33] Lincoln to Coxe, July 26, 1796; M9; BL Papers; MHS.

[34] "Cape Cod, Mass. Light Station," survey by E.P. Adams, Light House Surveyor, conducted December 18 to 23, 1885. One set of survey drawings found at the USCG Academy Library, microfilm, New London, CT; one set found in files of USCG Civil Engineering Unit (CEU), Providence, RI.

[35] Shebnah Rich, *Truro, Cape Cod* (1883; reprinted Rutland, VT: Charles F. Tuttle, 1988), p. 208.

[36] Rich, p. 207. In deeds of the 1790's and early 1800's the name is commonly rendered as Tashmute. In this form, one may discern in the second syllable a resemblance to Shawmut, the peninsula on which Boston was founded, a name also supposedly derived from the presence of springs.

[37] Harland Hamilton, *Historical Lighthouse of Long Island Sound* (Wescott Publishing, 1987).

[38] Holland, p. 12; Snow, p. 233.

Despite the obvious hardships and disadvantages of a keeper's position, among them the fact that it was a political appointment and therefore subject to sudden termination, there was great competition for the appointments. It is known that there were several other candidates for the Cape Cod post.[39] Lincoln, however, must have made his preference clear. In acknowledging the inquiries, Coxe pointedly observed that "General Lincoln's wishes are in favor of Isaac Small. The land bought for the site of the Lighthouse was purchased of Mr. Small, who owns the adjoining grounds. It is probable therefore, that economy in regard to fencing and salary may be made by appointing him."[40]

Specific Location

Only a portion of the total tract purchased was suitable for the construction of a lighthouse. The conveyance was calculated from the "high water mark," and therefore includes a small strip of beach and a considerable horizontal distance occupied by the slope of the cliff.[41] Thus the statements made later by Isaac M. Small, John Grocier, and others to the effect that at a given time only three or four acres remained of the original 10 are misleading, since the government never owned 10 acres of land on top of the bluff. Beyond that, it is reasonable to suppose that even the 1797 structures were located some distance back from the edge of the cliff. In sum, the area in which former lighthouses could have been located was quite limited.

Given this limited range, it is still difficult to pinpoint the precise location of the first Cape Cod Lighthouse, due to the absence of explicit documentation on the matter. The contracts and other records related to the building of the lighthouse do not provide information about its exact location. However, other evidence suggests that the first lighthouse stood on about the same site as the second lighthouse (which, as will be shown subsequently, stood on about the same site as the present lighthouse).

One of the most emphatic statements on the matter came from Isaac M. Small. Small spent virtually his entire life (1845-1934) in the vicinity of the light, and was the son and grandson of keepers of the light. In his publication "Highland Light," he asserted that "The present tower stands upon the EXACT SPOT WHERE THE ORIGINAL TOWER STOOD, IT HAS NEVER BEEN MOVED OR THE LOCATION CHANGED."[42]

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[39] Coxe to Secretary of the Treasury, June 16, 1797; M63/1; LH Letters; RG 26; NA/MA.

[40] See footnote 39.

[41] In the earliest estimate of the slope that has been found, Henry D. Thoreau in 1855 calculated that the bank at the lighthouse was 110 feet perpendicular and 175 feet "on the slope." He added that the "shelf slopes four and ordinary tide-fall is nine," making 123 feet in all. *The Journal of Henry D. Thoreau* (New York: Dover Publications, 1962), Vol. VII, p. 437, entry for July 11, 1855.

[42] Isaac M. Small, *Highland Light*, 1927 ed., p. 5 (upper case in original).

Small's statement would seem to rule out any supposition that the first lighthouse occupied a different site than the subsequent ones. However, careful analysis suggests otherwise. In general, the accuracy of Small's writings about the lighthouse diminishes as he goes farther into the past. He is not reliable about the early history of the lighthouse, which makes it evident that he did not have access to documentary sources. He fails to mention in his pamphlets that his grandfather was the first keeper; this is the sort of human interest he probably would have exploited if he were aware of it.

More specifically, a careful reading of Small's pamphlets suggests that he was unaware that another lighthouse existed between the one built in 1797 and the present one. He thought that the lighthouse he saw being replaced by the present one was the one built in 1797. Thus, he was correct in asserting that no change in location had occurred *between those two*. His ignorance of the second lighthouse seems hard to believe, since Small's father James Small certainly knew about the intervening light. James Small was a literate man, judging by his letters, who became a leading member of his community. He was nearly 30 when his father Isaac Small (the first keeper of the light) died, and was well into his 40's when the second lighthouse was built. It seems inconceivable that he never told his son about the second lighthouse, even though there was a great age difference (58 years) between the two.

A more reliable source is Henry David Thoreau, who apparently visited the Cape Cod Light four times between 1849 and 1857, according to his journals. Thoreau's descriptions therefore apply to the second, circa-1831 lighthouse and keeper's dwelling. This is confirmed by an article by Thoreau that appeared in *The Atlantic Monthly* in 1864.[43] The article, which mentions the lighthouse, was published after Thoreau's death. The magazine felt compelled to add a footnote to the article, which stated that "The light-house has since been rebuilt, and shows a Fresnel light."[44] This clearly refers to the third lighthouse.

In one journal entry, Thoreau confirms—if in a rather offhand fashion—that the second lighthouse stood on the same site as the first: "[James] Small says the lighthouse was built about sixty years ago. He knows by his own age. A new lighthouse was built some twenty-five years ago. They are now building another still on the same spot."[45]

Thoreau also records speaking with "Uncle Sam" Small, 66 years old in 1855, who remembered the building of the first lighthouse.[46] Probably referring to "Uncle Sam," Thoreau noted that "One old inhabitant told us that when the light-house was built, in 1798, it was calculated

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[43] Thoreau, "The Highland Light," *The Atlantic Monthly* (Boston: Ticknor and Fields, Vol. XIV, December 1864 [annual binding]), p. 649.

[44] Thoreau, "Highland Light," p. 656.

[45] Thoreau, *Journal*, June 18, 1857 (Vol. IX, p. 441).

[46] Thoreau, *Journal*, July 8, 1855 (Vol. VII, p. 437).

that it would stand forty-five years, allowing the bank to waste one length of fence each year."[47] If a "length of fence" is considered to equal a rod, the resulting total would exceed 700 feet, or more than the available width of the government tract. Thoreau clearly examined the subject in considerable detail, and his conclusion that the two lighthouses were located near one another is strong evidence for that point of view.

On the opposite side of the ledger is a tradition of uncertain origin that has been passed down through the Coast Guard, to the effect that the original lighthouse was located "about 600 feet to the seaward of the present structure."[48] Lacking substantiation, this assertion could be easily dismissed, except that it may have indirect support in the writings of Benjamin Lincoln. When Gen. Lincoln returned from his initial visit to the Highlands in July 1796, he reported to Coxe that "This land which I have purchased is about fifty rods [825 feet] East of a public road, the light house will stand about eighty rods [1,320 feet] from the road."[49] Even allowing for the fact that these figures are only casual estimates, not based on measurement, the distance from the road is seriously mistaken. According to a 1945 survey, the measured distance from South Highland Road along Highland Road to the boundary of the lighthouse tract is more than 97 rods (1,600 feet). Highland Road is relatively straight, so that even calculating a straight line between the closest points on South Highland Road and the government boundary saves only about 75 feet.[50]

Lincoln's assertion that the lighthouse would be 30 rods inside the property line may still be valid, however, since he would have been more careful with this estimate. Thirty rods equals nearly 500 feet—close to the tradition of 600 feet. However, there is no evidence that the lighthouse was actually built in the location Lincoln envisioned during his visit. Given the configuration of the government tract, a site 500 or 600 feet east of the west boundary would be perilously close to the edge of the cliff. It was evident even at that time that significant erosion was occurring at the site. (Thoreau's previously cited conversation with an "old inhabitant" who was alive at the time the first lighthouse was constructed indicates that the rate of erosion was then thought to be about one rod per year.) It is therefore likely that even if Lincoln initially contemplated building nearer the edge of the cliff, he reconsidered after further analysis.

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[47] Thoreau, "Highland Light," p. 650.

[48] Robert E. Holbert, Officer in Charge, Cape Cod Light Station, to Commander, Coast Guard Group, Woods Hole, July 22, 1968 (memorandum in response to a request for information on unit histories), U.S. Coast Guard historical files, Washington, DC. It should be noted that this memorandum contains several inaccurate or confusing statements. Also, it is not clear that the writer was aware of the existence of a second lighthouse.

[49] Lincoln to Coxe, July 26, 1796; M9; BL Papers; MHS.

[50] John R. Dyer, "Plan of Land in North Truro belonging to Lillian M. Small, December 1945"; Barnstable County Plan Book 78, p. 113; Deeds.

Contracting

Once the location of the lighthouse had been determined, the next order of business was to contract for its construction. This responsibility, too, was generally assigned to the superintendent. At that time the procedure was less formal than it later became under a mature bureaucracy, although the practice of publicly advertising for bids was well established. There was, at a minimum, some standardization of design—if only because it made specifications easier to prepare. Coxe had informed Lincoln early in the process that "the sum granted limits us to a wooden building."[51]

By then the government had gained considerable experience building lighthouses of this type. On December 7, 1796, Lincoln recommended to Coxe that the Cape Cod light should be from 40 to 45 feet high. He suggested that "the light-house on Nantucket will be a good model for this and the lantern and lamps of the light-house there, which is thought to be the best on the continent will also be a good model. . . ."[52] This is a reference to the recently completed (1784) wooden lighthouse at Great Point, rather than to the older and much smaller light on Brant Point at the entrance to Nantucket harbor.

On January 24, 1797, Coxe responded by transmitting to Lincoln "a plan and detailed description of a Light-House, keeper's house and Oil vault for Cape Cod." He added that "If a barn or stable be necessary you will be pleased to add the description of one according to some moderate approved plan."[53] Coxe's letter indicates that he was unaware of the special circumstances presented by Isaac Small. In his letter of December 7, 1796, however, Lincoln had noted that the lighthouse "will be but one fourth of a mile from a number of Houses, consequently a small house will for the keeper answer all public and private purposes."[54] Even though Small occupied one of these houses, a separate dwelling for the keeper was still needed: the lighthouse was expected to last longer than any one keeper's tenure, and Small could not be expected to trudge a quarter of a mile daily through some of the violent weather experienced in the Highlands. For Small, with a fully functioning farm adjacent to the lighthouse, a large barn or stable would not have been necessary.

Soon after, Lincoln must have placed an advertisement for "propositions" to build the lighthouse. He also advised Coxe that he had made a few modifications in the specifications, changing such details as the size of the keeper's house and the size of the glazing. He also revised some of the wording to "make it a little more explicit and more conformable to the language of the people in this part of the country."[55]

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[51] Coxe to Lincoln, June 11, 1796; Letters BC; Correspondence; RG 26; NA/MA.

[52] Lincoln to Coxe, December 7, 1796; M9; BL Papers; MHS.

[53] Coxe to Lincoln, January 24, 1797; Letters BC; Correspondence; RG 26; NA/MA.

[54] Lincoln to Coxe, December 7, 1796; BL Papers; MHS.

[55] Lincoln to Coxe, February 8, 1797; M9; BL Papers; MHS.

For nearly a year, from the approval of the federal appropriation on May 17, 1796, the process of establishing Cape Cod Light had proceeded routinely, insofar as regular procedures existed in those tentative years of the lighthouse administration. However, the proposal signed on March 2, 1797, proved to be a shock. In that document, General Benjamin Lincoln—Collector of the Port of Boston and Superintendent of Lighthouses—contracted on behalf of the federal government to build the Cape Cod Lighthouse with one Theodore Lincoln, his son.

Coxe, though a suave individual, seemed to be jolted by this turn of events. He informed Treasury Secretary Alexander Hamilton that "It has appeared proper to scrutinize this case with more than common strictness, because the proposal is from . . . a son of the agent of the United States." He went on to assure Hamilton that "the integrity and candor of General Lincoln rendered a satisfactory issue to the scrutiny highly probable."[56]

A week later Coxe wrote to Lincoln, advising with his customary diplomacy that "I feel myself influenced by personal regard and esteem and by a certain degree of delicacy in the situation of the Government, to suggest to you the expediency of a call upon Mr. Freeman [Nathaniel Freeman of Plymouth, the member of Congress whose district included Barnstable County] with an explanation of the circumstances of the case, price excepted."[57] Coxe noted that he had received a letter from Rep. Freeman, and although he did not divulge its content, the implication is clear that the congressman was questioning the propriety of the award. Coxe added significantly, "Should no lower offer be made, all delicacy, both personal and official, will be perfectly saved and preserved." This puzzling statement suggests that Gen. Lincoln had awarded the contract before the deadline, unless—as he stated in a nearly simultaneous letter to Rep. Freeman—Lincoln was prepared to receive new proposals.[58]

In an earlier letter Lincoln had tried to assure Coxe that he had attempted to find a more conventional contractor, or at least to pave the way for the startling one he submitted. On March 8, 1797, he informed Coxe that "the gentleman . . . from Cape Cod who I supposed would probably contract for building the light-house if any person in that part of the country would do it . . ." had proved to be "totally out of the line of [the] business, which is confined to the fishery."[59]

Lincoln further sought to reassure Coxe in a letter dated March 28, which must have crossed Coxe's admonition in the mail. He enclosed with this copies of letters he had received from and written to Rep. Freeman. Referring to Freeman's letter, he added that "Besides what I learn from the letter I am told by the bearer that the writer appeared warm on the subject." Lincoln believed that Freeman had actually hoped to build the lighthouse himself or to have "an interest in the

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[56] Coxe to Hamilton, March 20, 1797; M63/1; LH Letters; RG 26; NA/MA.

[57] Coxe to Lincoln, March 27, 1797; Letters BC; Correspondence; RG 26; NA/MA. It is not known whether Rep. Freeman was related to Rev. James Freeman.

[58] Lincoln to Rep. Nathaniel Freeman, March 28, 1797; M9; BL Papers; MHS. No copy of an advertisement soliciting bids, which might clarify the point, has been found.

[59] Lincoln to Coxe, March 8, 1797; M9; BL Papers; MHS.

business" and had expressed this wish to Coxe.[60] It is easy to see where the provision found in many federal appropriations prohibiting members of Congress from having a direct interest in the subject originates. The general also expressed surprise at Mr. Freeman's complaint, "since it was on a business he has had long in contemplation & since the post passes every week by his door with the newspapers and probably saw the advertisement in two days after it came out."

Lincoln explained to Rep. Freeman that he "wished more time could have been given . . . for the reception of propositions," but supposed that "the public interest required an early decision . . . as the time for cutting the timber would be soon over and that a longer delay would give too little time to any contractor to provide & transport the materials & compleat the works before the inclement season of the year would commence."[61] He further sought to conciliate Freeman by offering to surrender the contract if other proposals "from your quarter" would be found more favorable, provided that the new contractor would take from Theodore Lincoln the timber and other materials he had already prepared. This proviso is significant in revealing the Lincolns' main interest in the contract. Benjamin Lincoln owned vast tracts of wild land in Maine, and the only product that could quickly repay this speculation was timber. Letters from Theodore make it clear that the market for timber was then weak, and it was the opportunity to dispose of a shipload of timber, rather than the prospects of contracting as such, that attracted the Lincolns. The family did not go on to make a practice of building lighthouses, although another son—Martin—constructed the lighthouse on Gay Head, Martha's Vineyard, completed in 1799.[62]

In a letter to Coxe not long afterwards, General Lincoln displayed considerably less equanimity on the possibility of losing the contract, and he tried to impress on the commissioner the need for urgency. "I cannot help observing," he noted, "that this delay throws into the hands of [a new] contractor advantages now which did not exist when my son made his proposition." This, he claimed, was due to a "general stagnation of business" that had ensued since the original bidding, which might enable a new entrant to come in with a lower offer.[63] Almost simultaneously Theodore was writing from Maine that he would "go on to prepare" (meaning the timber) "as if the contract was really confirmed," and Benjamin Lincoln's nervousness about the contract was probably intensified by his knowledge that the work in Maine was far advanced.[64]

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[60] Lincoln to Coxe, March 28, 1797; M9; BL Papers; MHS.

[61] See footnote 60.

[62] Treasury Secretary Wolcott to Benjamin Lincoln, October 4, 1799 (request to pay Martin Lincoln the balance due him); Entry 89; Correspondence of the Secretary of the Treasury with Collectors of Customs; Treasury Department Records, Record Group 56; NA/DC.

[63] Lincoln to Coxe, April 7, 1797; M9; BL Papers: MHS. These letters are from a letterbook or copybook kept by Lincoln. Much of this letter is crossed out, but even if it was not transmitted to Coxe as drafted, it reveals the direction of Lincoln's thinking.

[64] Theodore Lincoln to Benjamin Lincoln, April 6, 1797; roll 10, microfilm (M10); BL Papers; MHS.

Events justified Gen. Lincoln's decision, or at least prevented further embarrassment. No lower bids were received, or if made, were not accepted. At that time of limited government, the contract was approved directly by the President. Washington, who had a close relationship with Benjamin Lincoln during the War for Independence, had recently been replaced by John Adams. The new president, who—like Lincoln and Rep. Freeman—lived in a town on the shores of Massachusetts Bay, approved the contract with Theodore Lincoln on March 27, 1797.

The agreement as signed differed little from the proposal submitted by Theodore Lincoln (app. E). It called for an octagonal wooden tower 45 feet to the top of the floor of the lantern, supported on a stone foundation. The lantern was to be 6 feet in diameter and 8 feet high. The keeper's dwelling was to be a one-story structure measuring 25 by 27 feet. This was somewhat larger than the 34 by 16 feet Benjamin Lincoln had earlier believed would be adequate.[65] Included in the plan were a separate oil vault 12 by 16 feet and covered by a shed, a well and accessories, and a small barn 15 feet square.[66] An assistant keeper's dwelling was not part of this proposal.

No clauses referred to the specific location of the structures. The provisional agreement stated that the lighthouse would be built "on such part of sd land as the United States shall point out," but the actual contract did not even contain that language.

In April Coxe sent formal notices to two unsuccessful bidders for the lighthouse contract. Their bids of $7,000 and $9,500 were higher than Theodore Lincoln's proposal of $6,500. This relieved any qualms Coxe might have felt, and on April 25, 1797, he transmitted to Benjamin Lincoln an approved copy of the contract for "the light house near the Clay ponds on Cape Cod."[67] Subsequent figures in the lighthouse records show that the cost of the Cape Cod installation was $7,257.56. However, this includes items such as an eclipser that were not part of the original contract, and does not necessarily indicate that there was an overrun in Theodore's contract.

On the other side of the ledger, there should have been a saving due to the modifications the Lincolns made in the original contract. At an early date the Lincolns sought to amend the contract by substituting shingles for clapboards on the dwelling, and by placing the oil vault inside the dwelling and reducing its size. Coxe agreed that the original dimensions of the vault were in excess of need, but he displayed considerable uneasiness about the other modifications, or perhaps the way they seemed to be forced on him. "The alterations you propose would have been more agreeable in the original plan," he observed pointedly. He added that "The placing of the oil vault under the same roof with the dwelling House is against the practice heretofore observed."[68] Somewhat

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[65] Lincoln to Coxe, December 7, 1796; M9; BL Papers; MHS.

[66] Maine-Mass. Box 003, Entry 153; Civil Contracts for Lighthouse Service, June 4, 1800 - March 17, 1903 (Civil Contracts); Records of the Accounting Officers of the Department of the Treasury, Record Group 217 (RG 217); NA/DC.

[67] Coxe to Lincoln, April 25, 1797; Letters BC; Correspondence; RG 26; NA/MA.

[68] Coxe to Lincoln, June 2, 1797; M63/1; LH Letters; RG 26; NA/MA. This letter does not specify Cape Cod, but the subsequent communication makes it clear that the reference is to this light.

grudgingly Coxe approved the changes, provided "Nothing, however, is to make the establishment cost more."[69]

Construction

If the choice of contractor provided reason for consternation, the actual construction proved even more extraordinary. It developed that the contractor, Theodore Lincoln, had little to do with the construction of the lighthouse; instead his father, the collector, largely supervised the project. This situation is not evident in the official Treasury Department records, but is plainly visible in the Lincoln family papers.

Benjamin Lincoln's rise from yeoman of Hingham to major general in the Continental Army is an exceptional story, and it is surprising that it has not been chronicled in a full-length biography. The "American Cincinnatus" was a devoted family man, caring deeply for his wife and their 11 children. He had entrusted his son Theodore with the management of his lands in Maine, and Theodore remained there (in the "eastern district") during the entire time the Cape Cod Light was under construction. He was informed of the progress of the contract for which he was responsible only through his father's letters.

On May 27, 1797, Theodore wrote to his father "I am very happy to hear that the affairs of the light house are likely to turn out so well. . . ."[70] Given the slowness of communications to the Maine coast, he was probably not yet aware of the final approval of his contract, but had been given an optimistic assessment of its prospects. He informed the General that the *Ranger*—the schooner they owned or chartered—"has now on board all the articles for the Cape & a quantity of wood & boards which will be landed at Hingham." He added that "boards are so very low that it is not an object to saw them," thereby explaining the urgency Benjamin Lincoln felt about retaining the contract, or at least the right to supply lumber for it.

The exterior of the lighthouse structure was largely complete by the time Theodore next heard from his father. In a long letter dated July 28, disjointed as a result of "frequent official interruptions," Benjamin brought his son up to date on the project. Despite his age (64) and extreme corpulence, the General had personally supervised the raising of the lighthouse during the preceding week—his third trip to the Cape that year. Obviously not disturbed by possible impropriety, he informed Theodore that he had borrowed the blocks and rigging from the Continental ship yard. He also took down "the cutter," presumably the official vessel to which he was entitled as collector.

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[69] Coxe to Lincoln, June 14, 1797; M63/1; LH Letters; RG 26; NA/MA.

[70] Theodore Lincoln to Benjamin Lincoln, May 27, 1797; M10; BL Papers; MHS.

As a result, he concluded, "the cost of doing this will not exceed 50$ on a hundred dollars we estimated the expense of it."[71]

General Lincoln reported that "We raised the light house without an accident and it came well together." He does not specify whether it was raised as a unit or in sections that were then fastened together, as was the usual method of erecting barns. He then made a new contract with the carpenters to perform interior work on the tower, the keeper's house, and the oil vault.

Lincoln boasted of another substantial saving in expenses as a result of bringing his own team of oxen over from Hingham. By this expedient he calculated the cost at only $180, instead of a figure of at least $450 the local residents would have charged for the same service. Lincoln was clearly concerned that he would have been vulnerable to gouging by the locals if they saw that he was dependent on them. The supply of building materials had been a source of concern to Lincoln, as he expressed in several of his letters, since lumber, brick, and even stone was not readily available on that part of the Cape. The nearly contemporary "Topographical Description," for example, depicted that part of Truro as "free from rocks and stones." By using his own vessel, General Lincoln had access to the fieldstones that were abundant in the Hingham and Braintree area.

The difficulties of supply and transport seem to have had a direct impact on the overall cost of the Cape Cod project. At $7,258, Cape Cod Light cost about the same ($7,170) as Seguin, built on a remote island off the coast of Maine. Other wooden lighthouses built in Massachusetts during this period cost considerably less: Baker's Island at $4,602 and Gay Head at $3,041. Several southern lighthouses were much more expensive, but they were built of stone and so are not comparable.[72]

The use of his own equipment and that of the government helped Lincoln minimize the expense of materials and transportation, factors he had cited as making it difficult to obtain a low bid on the Cape Cod project. The problem of carting was at least as acute as that cited earlier at Cape Hatteras, because it was impossible to land cargo on the ocean side of Truro. Indeed, as the "Topographical Description" relates, it is questionable whether there was a usable port even on the bay side of Truro at that time.[73] Lincoln speaks of hauling "over the peninsula," but does not specify from where. Probably the small harbor at the Mouth of Pamet was adequate for the purpose.

Lincoln also informed his son that the "iron work of the lantern is nearly done." It was, he said, supposed to come to Boston to have "the roof covered, the ventilators put on &c" by the last of July or the first of August. As a result of this gratifying progress, the general predicted that the building would be entirely finished by the middle of September, instead of November as had been

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[71] Benjamin Lincoln to Theodore Lincoln, July 28, 1797; M10; BL Papers; MHS.

[72] Lighthouse Annual Report, 1800; M63/2; LH Letters; RG 26; NA/MA.

[73] "A Topographical Description of Truro," p. 196; MHS.

expected.[74] In a letter dated August 15, Lincoln conveyed the same information to Coxe.[75] He seems to have remained on schedule, for on August 22 he informed Coxe that "I have the lantern on board the vessel for Cape Cod with the rods &c and am waiting for a wind. The workmen go to overlay the platform with copper and to paint the whole so that in a very short time the lamps may be lighted."[76]

Theodore Lincoln, the ostensible contractor, may never have set foot on Cape Cod, and learned of the project only as the *Ranger* or some other vessel carried letters from Massachusetts Bay to Maine. For obvious reasons, the information he received was gratifying. On September 5, 1797, he wrote, "I am extremely pleased to hear that the affairs of the light house draw so nigh a close."[77] Later that month he told his father that "I am pleased to hear that you will probably have it in your power to forward me a statement of the affairs of the light house by the next trip."[78]

Completion of the lighthouse apparently remained on its accelerated schedule. Lincoln informed Coxe on September 6 that "The lantern is up and there wants nothing to compleat it but setting the glass which is there. [T]wo or three days with the carpenters will compleat the whole of their work. The vault is done the cistern set in clay by the masons so that the whole might be compleated in four days at most."[79] Thus the lighthouse must have been essentially finished by mid-September, as Lincoln had predicted. It was definitely completed by November 8, 1797, the date upon which Isaac Small's service as keeper officially commenced. When Coxe informed Lincoln on June 22, 1797, of Small's appointment, he stipulated that the keeper's salary would "commence from the time the Light house shall be completed for lighting."[80] This occurred on November 8, when Lincoln sent formal notice of the appointment and transmitted the standing instructions to Small.[81] However, the light was probably not illuminated until January 15, 1798, due to the difficulty of procuring an eclipser for it. As will be described in the following section, this mechanism was necessary in order to distinguish the Cape Cod Light from other lighthouses.

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[74] Benjamin Lincoln to Theodore Lincoln, July 28, 1797; M10; BL Papers; MHS.

[75] Lincoln to Coxe, August 15, 1797; M9; BL Papers; MHS.

[76] Lincoln to Coxe, August 22, 1797; M9; BL Papers; MHS.

[77] Theodore Lincoln to Benjamin Lincoln, September 5, 1797; M10; BL Papers; MHS.

[78] Theodore Lincoln to Benjamin Lincoln, September 22, 1797; M10; BL Papers; MHS. The letter from Benjamin to which this seems to be a reply is not included in the collection.

[79] Lincoln to Coxe, September 6, 1797; M9; BL Papers; MHS.

[80] Coxe to Lincoln, June 22, 1797; Letters BC; Correspondence; RG 26; NA/MA.

[81] Lincoln to Keeper, Cape Cod Light, November 8, 1797; Letters BC; Correspondence; RG 26; NA/MA.

At that time, structures on the site included the lighthouse tower, a principal keeper's dwelling with seven "strong" cisterns, a well, and a small barn.[82] As explained previously, the separate oil vault included in the original proposal was not constructed. There was no dwelling for assistant keepers.

Distinguishing the Light

Cape Cod Light represented an important step in the gradual but somewhat random evolution of a coherent system of lighting the New England coast. Writing to Lincoln soon after learning of the appropriation to build the lighthouses at Baker's Island and Cape Cod, Coxe observed that when the two additions were completed, "There will be five lights in the great bay of Massachusetts, including Cape Cod and Barnstable bays as parts thereof." From his office in Philadelphia he was perhaps able to take a more detached strategic view of the situation. He noted that "The prominent headlands are the Capes Cod and Ann, and they may be well lighted. In the Bottom of the Bay is the Boston light, one of the first order. Hence it will follow that the Plymouth and Baker's Island lights . . . will be best as secondary lights.[83] Indeed, it was probably at Coxe's suggestion that the act establishing the Cape Cod Light also contemplated a reduction or alteration of Plymouth Light.[84]

The increasing number of lights along the coast made the problem of differentiating them more acute. This is one of those issues that may puzzle landsmen. In the era of sail, and with radio direction-finding far in the future, a ship could emerge from a long spell of storm or fog without knowing its location within 50 or 100 miles. Discerning a light could be somewhat reassuring, but also confusing and even dangerous if it could not be definitely identified.

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[82] Contract for building lighthouse on Cape Cod March 2, 1797; Maine-Mass. Box 003, Entry 153; Civil Contracts; RG 217; NA/DC.

[83] Coxe to Lincoln, July 8, 1796; M63/1; LH Letters; RG 26; NA/MA.

[84] The Congressional act of May 17, 1796, that approved funds for constructing the Cape Cod Light included the following: ". . . and that the light or lights on Gurnet Head, at the entrance of Plymouth Harbor, be altered or diminished, if necessary." [Lighthouse Clipping File; RG 26; NA/DC.] Shortly thereafter, Coxe wrote that "The act contemplates an alteration of the present plan of the Plymouth light . . . . I think it probable that this may have been in consequence of a suggestion of mine, that a long dwelling House with a light at each end, might be expedient on Cape Cod, which would render it proper to reduce the two lights at the Gurnet to one. The existence of a good light in Boston bay and on Cape Cod will diminish the occasion for a great light at Plymouth." [Coxe to Freeman, June 9, 1796; Letters BC; Correspondence; RG 26; NA/MA.]

Early in the process of establishing the Cape Cod Light, Coxe toyed with the idea of making it a double light.[85] This was a common method of distinguishing lights; Plymouth and Baker's Island, among others, being double.[86] This technique suffered from obvious limitations, for under some conditions it was impossible to resolve visually the separate lights and if employed too frequently would defeat the purpose. Lincoln thereupon suggested creating a vertical double light, one above the other, to distinguish Cape Cod.[87] This proposal would only have created a different set of problems, and in the following months Coxe and Lincoln resorted to a wholly new approach.

After further consultation with the Marine Society, Lincoln reported to Coxe in December 1796 that they had decided a "blind" should pass before the light once a minute.[88] Obscuring the light at regular intervals would distinguish it from fixed lights in a similar latitude. Following up on his proposal, Lincoln informed Coxe four months later that he had discussed the subject with John Bailey, Jr., "whom I consider the first mechanical genius in this state." Bailey responded that he would take the matter into consideration.[89] Perhaps this letter served as an introduction, for on April 28, 1797, Coxe wrote to Lincoln that Bailey "exhibited at this office a complete working metallic model of the Machinery necessary to accomplish an alternate concealment and display of the lights in a lantern of from 4 feet to 11 feet diameter."[90]

Coxe concluded that "If he will confidentially exhibit either a real working machine, or a description and specification of a machine, and the price at which he will make one for Cape Cod light house, a decision can be had upon it without delay. . . ." This apparently did not occur, and Coxe spent the succeeding months in an increasingly agonized quest to procure a satisfactory clockwork eclipsing mechanism for Cape Cod. Such devices existed in Europe, but Coxe was reluctant to purchase from a foreign source. There is something charmingly typical of the age in Coxe's search, since the clockwork mechanism seemed to embody the underlying assumptions of the 18th-century enlightenment. Philosophers believed that the universe operated as something of a self-regulating mechanism, and this concept influenced the design of the American Constitution.

In August, with the completion of Cape Cod Light approaching ahead of schedule, Lincoln wrote to Coxe to stress the urgency of acquiring an eclipser.[91] Thereafter, a note of growing desperation is visible in Coxe's correspondence on the subject. On August 25 he gave Lincoln in effect permission to procure the equipment on his own. Several days later he asked Lincoln almost

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[85] Coxe to Freeman, June 9, 1796; Letters BC; Correspondence; RG 26; NA/MA.

[86] Snow, p. 151.

[87] Lincoln to Coxe, July 26, 1796; M9; BL Papers; MHS.

[88] Lincoln to Coxe, December 7, 1796; M9; BL Papers; MHS.

[89] Lincoln to Coxe, April 19, 1797; M9; BL Papers; MHS.

[90] Coxe to Lincoln, April 28, 1797; Letters BC; Correspondence; RG 26; NA/MA.

[91] Lincoln to Coxe, August 15, 1797; M9; BL Papers; MHS.

plaintively whether the Cape Cod Light might not be able to function "without Eclipsers for a time." [92] Lincoln thereupon consulted again with the Marine Society and reported to Coxe "that there would be the utmost hazard in establishing a light on Cape Cod without something by which it could be distinguished from Boston Light."[93] It appears that public notice had been given that an eclipsing light would commence in November, and Lincoln advised that a late change would "operate as a decoy and greatly endanger the lives and the property of our citizens."

Lincoln then seized the opportunity provided by Coxe and promptly contracted with Bailey to manufacture an eclipser. Bailey must have been confident in his design and sources of materials, for he promised to deliver the mechanism to the dock at Hingham on October 16, at a cost not to exceed $500.[94] Bailey must have delivered much as promised, for an inspection of Cape Cod Light in December confirms that the eclipser was in place.[95]

Except for making the necessary public announcements, no further obstacles remained to putting Cape Cod Light into service. The time was already late, for the preference was to place new lights in service before the darkest time of the year. Lincoln requested the Marine Society to prepare sailing directions based on the new light, which it published on January 2, 1798.[96] This document states that the lamps were to be lighted on January 15, and presumably they were.[97] Lincoln obviously considered that one of his responsibilities was the dissemination of information about aids to navigation. In 1799 he received a request for information from Edmund Blunt, who was then in the early stages of publishing the *American Coast Pilot*. Blunt noted that Lincoln had "contributed

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[92] Coxe to Lincoln, August 31, 1797; Letters BC; Correspondence; RG 26; NA/MA.

[93] Lincoln to Coxe, September 6, 1797; M9; BL Papers; MHS. Also see Baker, p. 74. The Boston Marine Society had earlier expressed a preference for an eclipser that would reveal the light for one minute and obscure it for the same period. After a discussion with Lincoln on September 5, the Society voted "that 80 seconds was the proper time for the eclipser to make one entire revolution." Probably Baker is correct in surmising that "here is a case of changing a vote to suit available equipment." In the same letter, Lincoln reported that Bailey had committed to produce a device with that characteristic, in which the light would be concealed 30 seconds and "discovered" (uncovered) for 50.

[94] Lincoln to Coxe, September 6, 1797; M9; BL Papers; MHS.

[95] Ephraim Harding to Lincoln, December 6, 1797; Letters BC; Correspondence; RG 26; NA/MA.

[96] Baker, p. 74. The sailing directions are reproduced in Appendix VI of Baker's book, pp. 314-15.

[97] Isaac M. Small, the son and grandson of keepers of the Cape Cod Light, asserts in his booklet *Highland Light* (Truro, 1927) that the lamps "first flashed their broad and welcome rays over the wide and shimmering surface of the ever restless Atlantic on the night of June 12th, 1797." Furthermore, he maintains that a temporary beacon was erected on the site in 1796 while the permanent light was under construction. The concept of citing sources is alien to Small, and nothing has been found in contemporary documents to substantiate his claims. This date thus appears to be another example of the mistakes he made when writing of the early lighthouses.

very largely" and hoped that this support would continue.[98] Lincoln probably complied in person and at length; although his formal education was limited to the common schools of Hingham, he had become a capable writer. He produced pamphlets extolling Maine lands, and journals of his travels while on official business, such as negotiating treaties with the Indians.

Cape Cod probably has the distinction of housing the first eclipsing mechanism in an American lighthouse, making it the first successful effort to distinguish lights by a means other than using multiple lights.[99] It appears that the mechanism did not function perfectly at the outset. The inspector who visited Cape Cod in December 1797 observed that the "blind operates badly. Some times it runs down in 8 hours and some times in 7 & 5. [The keeper] tells me that he has tried all ways by taking out and putting in the waits[sic]. It seems that the weather governs it very much so that it will not keep time properly." [punctuation added and most spelling corrected.][100] Apparently the clock drive did not run as long as anticipated, so that on the long nights of winter it required two windings. The need to do this was one of the main justifications for an increase in Isaac Small's salary from $150 to $200 a year in 1798.[101] Except for this defect, Lincoln seemed fully satisfied with the operation of the eclipser.[102] Several years later the Secretary of the Treasury asked Lincoln for a description of the Cape Cod machinery so that it might be used in a lighthouse planned for Watch Hill, RI.[103]

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[98] Blunt (or Blount) to Lincoln, March 18, 1799; M10; BL Papers; MHS.

[99] This researcher has not found any previous claim to this effect. Snow describes the device at length, apparently without recognizing its novelty (p. 252). It is quite clear from Coxe's correspondence that no similar mechanisms were in use in America; otherwise, there would not have been so much anxiety about obtaining one. On August 31, 1797, for example, he wrote "There is great difficulty in making this unknown machinery here. If we had a few sets of these most improved, say two, from each of the Countries mentioned [France and England], our ingenious workmen would copy and improve upon them." [Coxe to Lincoln, August 31, 1797; Letters BC; Correspondence; RG 26; NA/MA.]

[100] Ephraim Harding to Lincoln, December 6, 1797; Letters BC; Correspondence; RG 26; NA/MA.

[101] William Miller, Jr., Commissioner of Revenue, to Lincoln, October 6, 1798; M63/2; LH Letters; RG 26; NA/MA.

[102] Lincoln to Miller, March 17, 1798; M9; BL Papers; MHS.

[103] Albert Gallatin, Secretary of the Treasury, to Lincoln, July 22, 1806; Letters BC; Correspondence; RG 26; NA/MA.

Subsequent Development

When the Cape Cod Light was first illuminated, it was the 20th lighthouse in the country. All of the lighthouses that had been established previously were still in operation. Baker's Island, which had been authorized at the same time, went into service just two weeks before Cape Cod. Although the tower was unexceptional, the light on Cape Cod may have been the highest in the country because of the elevation of the ground on which it stood.[104] The light itself was not, as it became later, one of the brightest along the coast. In a letter of June 16, 1797 Coxe described it as a "lantern . . . of the second class."[105]

If the choice of the lighthouse site was indeed influenced by prospects of saving money through the appointment of Isaac Small, the decision was validated by subsequent events. Once the lighthouse was in operation, and Small was the keeper, his salary was in the lowest category. Even after being raised to $200 a year, his salary was the same as that of keepers at more settled places such as New London, Newport, Plymouth, and Portsmouth. An outsider at the isolated post on the Highlands of Truro, lacking Small's alternate sources of income, would surely have required a higher salary, and probably more and larger domestic buildings. By comparison, the keeper of Boston Light, where agriculture was impractical, received $333.33 a year.[106] Another consideration in determining salary was the height of the lighthouse, since it was less laborious to maintain a light in a low tower like that on the Highlands.[107]

There is some evidence that the construction of the first lighthouse was defective. A man apparently designated to conduct an inspection in December 1797 found serious problems, in addition to those noted previously concerning the eclipser. The inspector noted that 12 panes of glass had already fallen out because of the "woods leveling and srinking[sic]." He added that the copper dome was already leaking and that the ground "blows away verey fast so that it is gone in some places 6 or 8 inches below the hewed stone." His alarming conclusion was that "there must be some repairs

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[104] Accurate height figures are not available for every light then in existence, especially those built in colonial times, but most stood on much lower terrain and could not have attained a greater total elevation.

[105] Coxe to Secretary of Treasury, June 16, 1797; M63/1; LH Letters; RG 26; NA/MA.

[106] Lighthouse Annual Reports, 1799 and 1800; M63/2; LH Letters; RG 26; NA/MA. A striking illustration of the relationship between salary and lifestyle is the fact that the Boston keeper's salary had actually been lowered from $400 because of "favorable conditions of living." Presumably this referred to possibilities of providing subsistence by fishing, and perhaps the potential to bring in money by pilotage, as had been done by the first keeper of the light. [Putnam, p. 36.]

[107] Heights are not accurately known for all of the colonial lighthouses, however, Beavertail (Rhode Island,) 64 feet; Sandy Hook, 103 feet; and Boston, 75 feet after rebuilding in 1783, are known to have been higher. Cape Ann was about the same height as Cape Cod. [Holland, pp. 11, 69.]

made soon or the Light will be in danger before spring."[108] It would be interesting to know whether the writer of this dismal assessment was aware that the recipient of his letter was the builder of the lighthouse.

Apparently some problem also arose with the oil storage vault, because in the first weeks of the new lighthouse's operation, Isaac Small wrote Lincoln, "I do not think tis worth while to Do any thing with the volt [vault] move till you come Down for it gets so bleak in the winter seson that it will be very bad to [haul?] oil to the Lite from it."[109]

These defects must have been repaired sufficiently to allow the lighthouse to go on functioning adequately. Official records indicate that its first decade was generally uneventful. Keepers were subject to criticism for real or imagined problems with their lights, and on at least one occasion Small encountered difficulties of this sort. In 1804, having been informed by his brother that there was a complaint against his light, he wrote to Lincoln, "I beg the favor of you to let me No[sic] what the Complaint was. I don't no of aney thing Defishent[sic]. . . ."[110]

By the end of the decade, physical problems at the light had become too acute to be ignored. In his regular report for 1809, Isaac Small noted that 12 squares of glass in the lantern "was broke out by the wind last winter." In addition to needing putty to set the glass, he noted that "The Lighthouse has been built 11 years this Summer and has not been painted since it was first built. [T]he paint is wore of[f] very much. . . ."[111] This letter coincided with the departure of Small's patron Benjamin Lincoln, who resigned his post as collector on March 1, 1809, just before the arrival of a new national administration. The lighthouse administration itself did not change at this time; the activist Secretary of the Treasury Albert Gallatin, who had assumed direct control of lighthouses in 1802, retained this responsibility until the end of his tenure in 1813.

Small's report also coincided with increasing complaint about the Cape Cod Light. In a petition to Gen. Henry Dearborn, who had replaced Lincoln, many inhabitants of Provincetown and Truro defended Small's management of the light while agreeing that the light was inadequate. They blamed the trouble on the eclipser, which "reduces the Light in a very considerable degree, adding to the situation on which the Light House stands, upon a high bank, which from the water side of said Light, there is almost always a Vapour which intervenes to obstruct the Light."[112]

The defects of the eclipser are confirmed by the writings of Edward A. Kendall, an English traveler who passed through the area in 1808. After a visit to the Cape Cod Light, he described the eclipsing mechanism as "a semi-circular skreen, placed on a circular frame, which being moved by

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[108] Ephraim Harding to Lincoln, December 6, 1797; Letters BC; Correspondence; RG 26; NA/MA.

[109] Small to Lincoln, February 2, 1798; Letters BC; Correspondence; RG 26; NA/MA.

[110] Small to Lincoln, June 23, 1804; Letters BC; Correspondence; RG 26; NA/MA.

[111] Report of Isaac Small, 1809 [n.d., probably June]; Letters BC; Correspondence; RG 26; NA/MA.

[112] Petition to Henry Dearborn, February 23, 1810; Letters BC; Correspondence; RG 26; NA/MA.

clock-work, performs continual evolutions about the lanthorn."[113] He identified the problem as being due to the fact that "As the skreen is continually turning, the light is full only for a single moment in the course of each evolution; it is also totally eclipsed but for a single moment; but, during all the time between, it is no more than an obscure and imperfect light, with greater or less difficulty distinguished."

The history of the early lighthouse service, like an ocean voyage, is characterized by long periods of routine interrupted by occasional stormy spells of upheaval and controversy. Cape Cod Light provides an excellent example of these trends and issues. A phase of rapid change around 1810 is associated with Winslow Lewis (1770-1850), a shrewd Boston sea captain with entrepreneurial inclinations. Lewis, without ever holding an official position, exerted an immense influence on the American lighthouse establishment for almost 40 years. He obtained a patent on an improved lighting device, which most specialists consider to be a copy—and a copy of a version already obsolete, at that—of the Argand lamp, invented in Europe nearly 30 years earlier.[114]

Lewis was an active member of the Boston Marine Society and from 1818-20 its president, which gave him an influential base.[115] He also won the backing of Henry Dearborn. Although the national government was less friendly to New England's maritime interests than it had been during the administrations of Washington and Adams, Dearborn—who had made a respected name for himself during the War for Independence—retained good connections. At Dearborn's recommendation, Lewis was given a contract to convert all the nation's lighthouses to his new system. This was advantageous to the government because the Argand-type lamp consumed less than half as much oil as the older "spider" lamps.[116] An ideal situation was thus created, in which Lewis received a handsome payment while the government saved money overall.

In April 1811 Lewis reported that he had prepared the new "apparatus" for installation in the Boston and Cape Cod lights.[117] In consequence, Isaac Small notified Dearborn that he had removed the "Elipses" as he called them from his light on May 20.[118] The enormous effort and anxiety that had accompanied the installation of the eclipser was thus negated when the light was converted to a fixed aspect. Lewis had tested his lamps in the Boston light, where they proved to be an unqualified success. An examination left the Marine Society so impressed that they could describe the contrast between the new and old lights only in terms of the difference between the sun and the moon. The society—perhaps not an altogether disinterested observer—concluded that "when

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[113] Edward Augustus Kendall, *Travels through the Northern Parts of the United States in the Years 1807 and 1808* (New York: I. Riley, 1809), Vol. 2, p. 161.

[114] See Sarah C. Gleason, *Kindly Lights* (Boston: Beacon Press, 1991), Chapter 3, for a fuller discussion.

[115] Baker, p. 75.

[116] Holland, p. 15.

[117] Dearborn to Gallatin, April 15, 1811; Letters BC; Correspondence; RG 26; NA/MA.

[118] Small to Dearborn, June 1, 1811; Letters BC; Correspondence; RG 26; NA/MA.

all of the lights in Boston Bay are fitted on Capt. Lewis's improvement . . . in almost any weather a ship may run into Boston Bay with safety and shall always be in sight of some one of the lights."[119]

Lewis had expected to install his lighting apparatus at Cape Cod, but other problems intervened. An examination of that light by another committee of the Marine Society revealed that the structure was so defective as to be unable to accommodate the new equipment:

> On examining the lantern, they found it much too small and very badly constructed, and very much out of repair the sashes are so constructed that the glass cannot be kept in them, the joints between the octagons part are a half inch open, and the whole lantern is in that situation as not to be able to keep a light in it, and it is our opinion, that there ought to be a new lantern of ten feet diameter, and the Light house cut down seventeen feet as we are of an opinion that the Light house now is much to[sic] high and would be seen at a much greater distance if the light was lower, and we are of an opinion that the alteration ought to be made as soon as possible . . . as we do not think a light can be kept in the lantern another winter.[120]

In transmitting this report, Dearborn added that "I am satisfied that [Cape Cod Light] was wretchedly constructed."[121] Dearborn may not have been aware that his predecessor was responsible for this "wretched" structure, but Lincoln had died the year before.

It is probably no coincidence that the recommendation of the Marine Society was similar to the plan proposed by Winslow Lewis, one of its prominent members. It seems contradictory to conventional wisdom to improve the performance of a lighthouse by reducing its height. In the specific situation of Cape Cod, subsequent correspondence makes it evident that one of the main complaints was that the light could not be seen "over the hills back of Provincetown" by ships crossing Massachusetts Bay. Whether or not due to "vapors," this condition is proof of the inadequacy of the light. The Gay Head Light, which—whether or not by coincidence—was built by another member of the Lincoln family, was lowered for similar reasons.[122] However, it would seem that the greater brilliancy of the Argand lamps would have been able to overcome this problem without reducing the height of the tower.

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[119] Dearborn to Gallatin, June 27, 1811; Letters BC; Correspondence; RG 26; NA/MA.

[120] Dearborn to Gallatin, June 27, 1811, transmitting the Report of Committee Appointed by Boston Marine Society respecting Cape Cod Lighthouse. The committee, consisting of Michael Hopkins, Aquilla Rich, and Henry Atkins, conducted its inspection June 15, 1811. [Letters BC; Correspondence; RG 26; NA/MA.

[121] See footnote 120.

[122] Willoughby, p. 201.

Lewis' proposal for modifying Cape Cod Light was too large to be funded out of existing appropriations. After further negotiation with Dearborn, Lewis signed an agreement on June 17, 1812, to perform the work, which consisted primarily of reducing the tower by 17 feet and installing a lantern 10 feet high, at a cost of $2000 (App. F).[123] Lewis had apparently made some changes in the lighting before undertaking his full contract, for keeper Small reported in February 1812 that Lewis had "fixt" his light with patent lamps.[124] Probably due to the War of 1812, the light was extinguished in October 1814.[125]

Another part of Lewis' agenda seemed to be to replace Isaac Small, and Small in turn began to feel threatened. After Lewis had installed the new lights, Small complained that they "require a great deal more attention & time to tend." In this letter Small, although determined to "get a good name by a good light," observed that "Capt Mikel Hopkins of Boston is underminden[sic] me to take the light from me for his brother Constant Hopkins."[126] Michael Hopkins was a member of the committee that had examined Cape Cod Light, and was therefore an associate of Winslow Lewis in the Marine Society. Lewis further undermined Small later in 1812, when he reported that "Mr Small's various pursuits will not allow him to pay any attention to the Light House."[127]

This campaign culminated soon after when Constant Hopkins was indeed appointed keeper, effective October 16, 1812.[128] Small had warned that Hopkins was "near seventy years of age which is no more fitting to tend the light than a child in the winter storms." In fact, Hopkins survived less than five years. The removal of Small after 15 years at his post necessitated a reversal of some of the considerations that had probably influenced his selection. While still fighting for his job, he reminded Dearborn that "As the road goes through the best of my land the United States and I must make a hundred or two lengths of fence to part my land from the [United] states[']' if it is taken from me."[129] Some of this concern proved to be well taken; in 1817 John Grocier, who had replaced Hopkins as keeper, reported soon after assuming his position that "I wish the land to be measured and fenced as there is so many cattle round the Light they brake the ground up that it

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[123] Lewis to Dearborn, June __, 1812; Letters BC; Correspondence; RG 26; NA/MA. Contract in Lighthouse Deeds and Contracts, 1790-1853; roll 2, microfilm M94 (M94/2); RG 26; NA/MA.

[124] Small to Dearborn, February 23, 1812; Letters BC; Correspondence; RG 26; NA/MA.

[125] Constant Hopkins to Henry A.S. Dearborn, October 4, 1814; Letters BC; Correspondence; RG 26; NA/MA. Henry A.S. Dearborn to Samuel Smith, Commissioner of Revenue, April 12, 1815; Correspondence; RG 26; NA/MA.

[126] Small to Dearborn, February 23, 1812; Letters BC; Correspondence; RG 26; NA/MA.

[127] Lewis to Dearborn, October 8, 1812; Letters BC; Correspondence; RG 26; NA/MA. The English traveler Edward A. Kendall had noted several years earlier that "I took shelter in the house of a farmer, who is also a miller, and the keeper of the light-house." (Kendall, p. 159.)

[128] Gallatin to Dearborn, October 16, 1812; Letters BC; Correspondence; RG 26; NA/MA.

[129] Small to Dearborn, February 23, 1812; Letters BC; Correspondence; RG 26; NA/MA.

blows away & there is no more than six acres for ten there ought to Bee."[130] This confirms that erosion was already a matter of concern, and also that there had never been a careful survey.

[130] Grocier to Henry A.S. Dearborn, May 21, 1817; Letters BC; Correspondence EL; RG 26; NA/MA. The new keeper's name is also given as Grozier or Grosier. He may have been a son-in-law of Constant Hopkins. Simeon L. Deyo in *History of Barnstable County* (New York: H.W. Blake, 1890), p. 947, notes that a John Grosier, born in 1791, was married to Mercy, a daughter of Constant Hopkins.

THE SECOND CAPE COD LIGHT

Administrative Background

A government reorganization in 1820 had long-lasting consequences for the lighthouse establishment. The administration of aids to navigation was placed under the jurisdiction of the Fifth Auditor of the Treasury, at that time Stephen Pleasonton. Historians of lighthouses have given Pleasonton generally poor reviews. Primarily a functionary, he emphasized controlling expenses. One of his proudest boasts was that American lighthouses cost less than half as much to maintain as those in Britain, disregarding widely perceived differences in quality. The number of lighthouses expanded greatly under Pleasonton, but he has been condemned for reluctance to adopt organizational and technical changes that would have made the system more effective. In particular, he has been criticized for resisting conversion to the more efficient Fresnel lens, as will be discussed subsequently.

Lacking experience with lighthouses, or indeed with any maritime matters, Pleasonton relied heavily on Winslow Lewis. This further strengthened Lewis' already powerful influence on lighthouse affairs. Certainly Lewis was unlikely to advocate replacing his Argand lamps with an entirely new technology, and Pleasonton saw little reason to challenge the views of his expert adviser. The careers of the two men became thoroughly interdependent, and as the years passed they fought together to hold back a rising tide of opposition.

Lewis favored standardized installations in the lighthouses he worked on, partly for his own convenience. This gave him an advantage in bidding for contracts, but neither he nor Pleasonton took a systematic approach to lighthouse needs. Decisions continued to be made on an individual basis, often subject to political pressure.

The Need for A New Light

By the late 1820's, the wooden lighthouse at Cape Cod had weathered severe conditions for 30 years. It was nearing the end of its useful life. Winslow Lewis's renovations had probably extended its career, but had only postponed the inevitable. In his report for 1828, the Boston superintendent reported that "The whole structure is very imperfect—is easily wracked by the winds,

which shakes the lantern so much as to break out the glass very frequently."[1] Interestingly, erosion was not cited as a reason for rebuilding the light.

A new superintendent, David Henshaw, advised Pleasonton in July 1829 that the old lighthouse should be replaced with a brick structure. As early as 1816 the Commissioner of Revenue had suggested to the superintendent at Boston that new lighthouses be constructed of brick or stone.[2] This had become standard practice, and by 1830 it is unlikely that any new wooden lighthouses were being built. Wooden lighthouses were largely a New England phenomenon. Despite its harsh environment, Cape Cod Light actually lasted longer than many of its wooden contemporaries: Nantucket Great Point, Seguin, and Baker's Island had all been rebuilt with stone before 1820.[3] Pleasonton delayed for a time, probably concerned about costs, but in 1831 obtained the Secretary's approval for the rebuilding.[4]

Site Selection

General Location

As described previously in connection with the first Cape Cod Light, it is clear that the decision was made to build the second lighthouse on the same tract of land as the first.

Specific Location

A consideration of all of the evidence pertaining to the siting of the three Cape Cod Lights indicates that: (a) the second lighthouse may have been built very near the former location of the first lighthouse; and (b) that the second lighthouse stood very near the location of the present lighthouse.

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[1] Annual Report, 1828; Box 2; Lighthouse Annual Reports, 1820-1853, Series 6 (Annual Reports); US Coast Guard Lighthouse Service, Record Group 26 (RG 26); NA/DC.

[2] Samuel Smith, Commissioner, to Dearborn, August 3, 1816; Letters Received by the Boston Collector (Letters BC): Correspondence, Series 17 (Correspondence); RG 26; NA/MA.

[3] Francis Ross Holland, Jr., *America's Lighthouses* (Brattleboro, VT: The Stephen Greene Press, 1972); Edward Rowe Snow, *The Lighthouses of New England* (New York: Dodd, Mead, 1973).

[4] Pleasonton to Henshaw, July 29, 1829; Pleasonton to Hon. Thomas Newton, February 8, 1830; Pleasonton to Henshaw, June 27, 1831; Letters Sent Regarding Lighthouse Service, 1792-1852, Series 18 (Letters Sent), RG 26; NA/DC.

Two pieces of evidence support the first contention, as stated previously in connection with the first lighthouse. First, only a limited part of the tract was actually suitable for lighthouse construction. Second, Henry David Thoreau visited the second lighthouse at least twice in the mid-19th century, and remarked in his writings on the proximity of the two locations.

Other evidence confirms that the second lighthouse was built very near the location of the present lighthouse. Two careful surveys conducted during the period of the second lighthouse indicate that it was located well back from the edge of the bank, which would have put it in close proximity to the location of the present structure. A survey in 1835 by Major J.D. Graham of the U.S. Topographical Engineers indicates that the lighthouse was approximately 440 feet from the edge (app. J).[5] Another survey, performed in 1848 by A.D. Bache, Superintendent of the U.S. Coast Survey (fig. 1), is even more persuasive.[6] This map shows a setback of approximately 440 feet for the lighthouse, and also depicts a fence line that indicates the lighthouse was situated at the extreme west edge of the government tract. The map seems to concur with the only known illustration of the second lighthouse (fig. 2), although it is not certain that the fence shown in the illustration marks the boundary of the government lot.[7]

Thoreau's writings support the close proximity of the second and third lighthouses, as well. He recorded during his 1855 visit that the second lighthouse stood "about twenty rods [total of 330 feet] from the edge of the bank, which is here formed of clay. . . . According to the light-house keeper, the Cape is wasting here on both sides, though most on the eastern. In some places it has lost many rods within the last year, and erelong the light-house must be moved. . . ."[8] (He does not, regrettably, state how close it was to the property line, which may not have been marked at the time.) This is almost the exact distance between the third lighthouse and the cliff edge shown on the 1885 survey. Some erosion probably took place in the intervening years, but Thoreau was making only a rough estimate. For example, the lighthouse itself was more than one rod in diameter, and Thoreau does not state where his measurement began. If one or even two rods had eroded in that period, it would not affect the underlying assumption that the lighthouse he was describing was adjacent to its replacement.

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[5] "A Report upon the Military and Hydrographical Chart of the Extremity of Cape Cod, Including the Townships of Provincetown and Truro with their Seacoasts and Ship Harbor, Projected from Surveys Executed during Portions of the Years 1833, 1834 and 1835, Under the direction of James D. Graham, Major, United States Corps of Topographical Engineers." Graham complained (p. 8) about the inadequacy of his instruments for calculating latitude and longitude, but this would not have affected his measurements on the ground.

[6] A.D. Bache, "Cape Cod from Highland to Nausett Lt. Topographical Survey made during part of July, August, September and October 1848"; Cape Cod NS files.

[7] "Highland Light, Truro, Mass.," from *Gleason's Pictorial*, Vol. XI, 1856; in the collection of Peabody Essex Museum, Salem, MA.

[8] Henry David Thoreau, "The Highland Light," *The Atlantic Monthly* (Boston: Ticknor and Fields, Vol. XIV, December 1864 (annual binding), p. 649.

One of the authors of this report attempted to discern the relationship of the second to the third lighthouse in another manner: by comparing the documented latitude and longitude readings recorded for the lighthouse location from 1833 to 1933 (see below). Unfortunately, these readings were not precise enough during the period being studied to give any useful insights.

Date	Latitude	Longitude
1833	42 02 19	70 04 22.50
1849	42 02 23	70 03 55
1852	42 02 40	70 03 30
1857	42 02 23.36	70 03 55.33
1860	42 02 21	70 03 18
1866	NA	70 03 38
1885	42 02 21	70 03 39
1891	42 02 22	70 03 40
1898	42 02 4N	70 03 3W
1908	42 02 23	70 03 40
1933	42 02 23	70 03 40

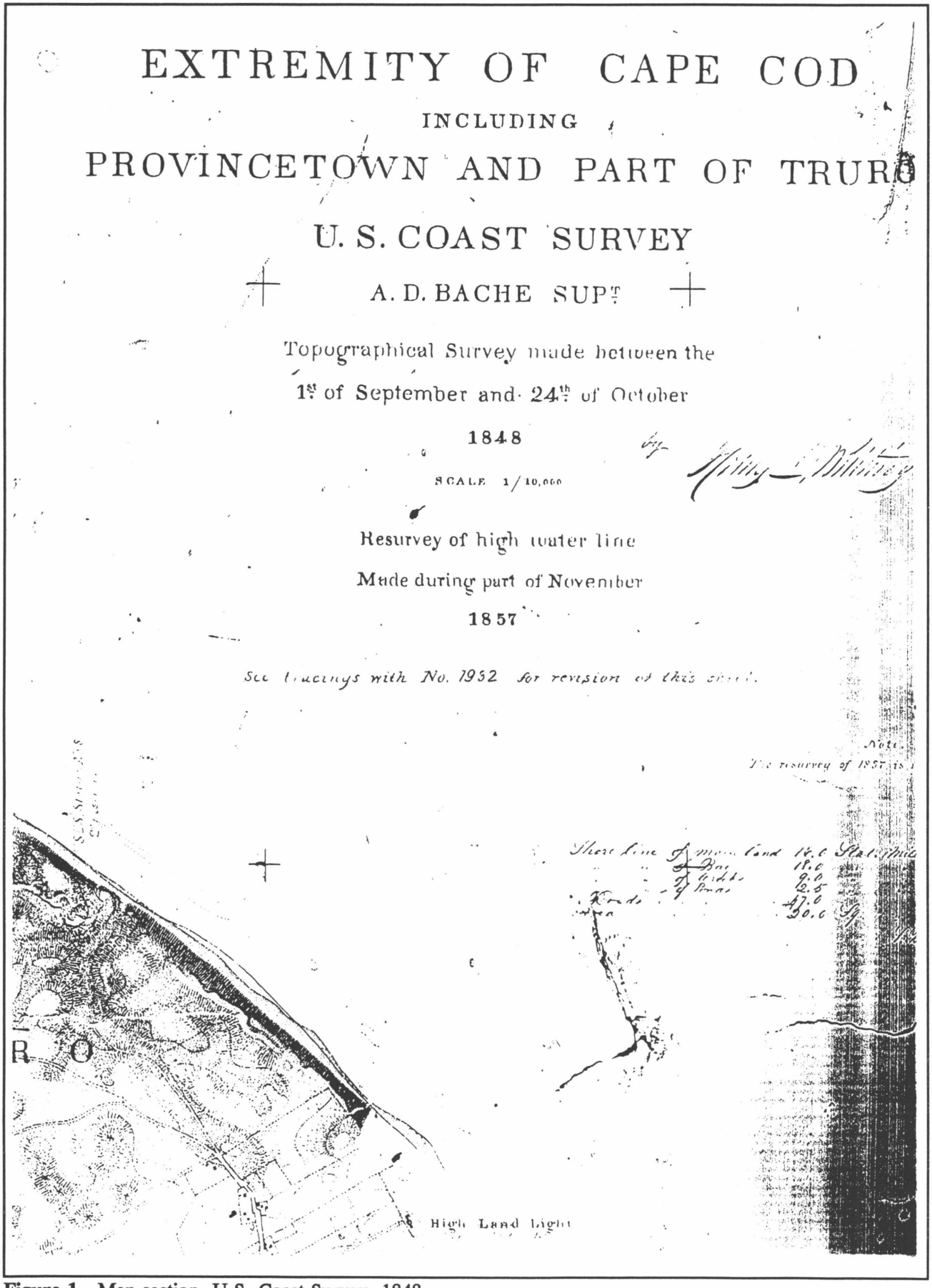


Figure 1. Map section, U.S. Coast Survey, 1848.

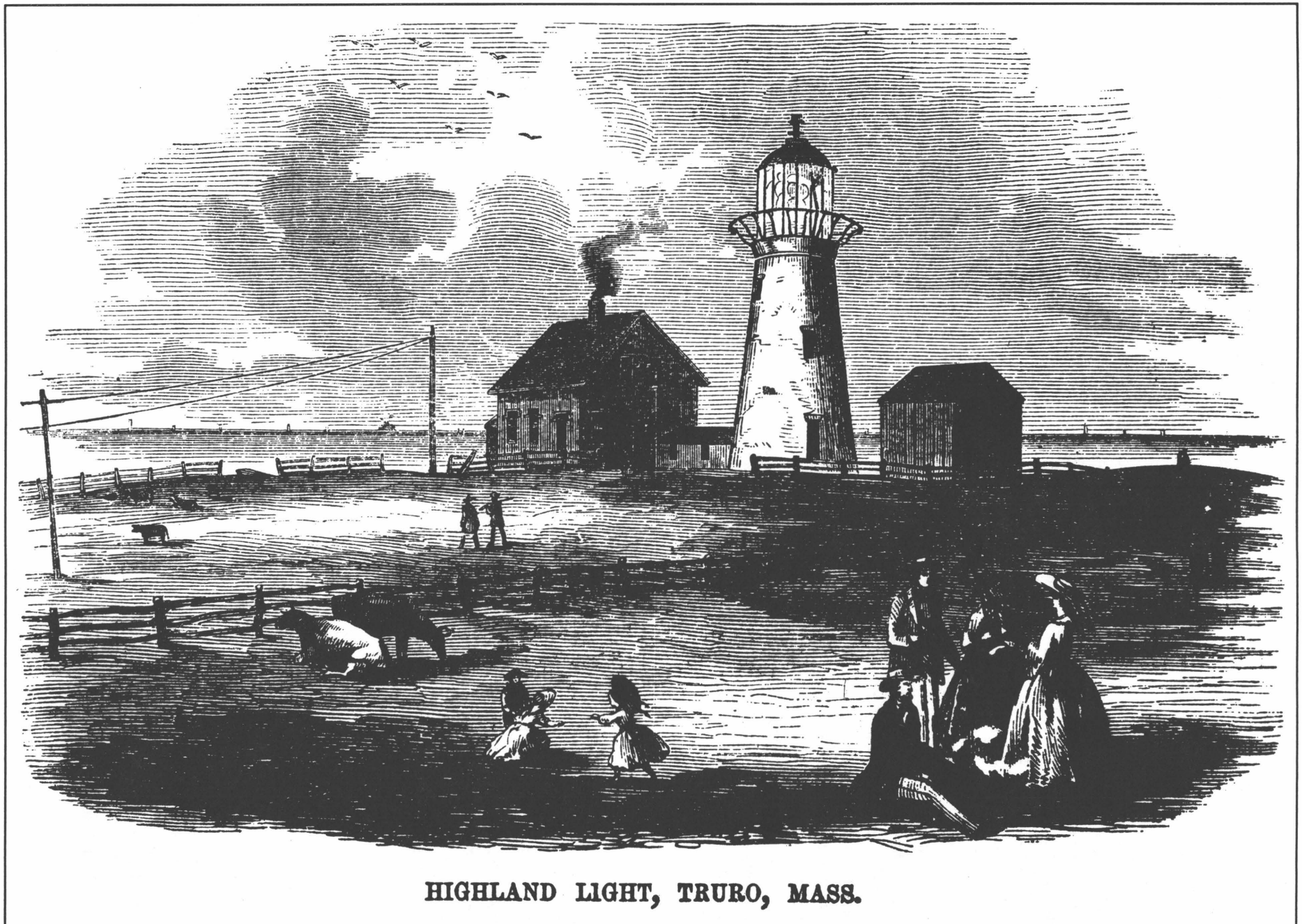


Figure 2. Illustration printed in *Gleason's Pictorial*, XI, 1856.

Contracting

Pleasonton informed Boston superintendent Henshaw of the decision to rebuild the Cape Cod Light in a letter dated June 27, 1831. In the letter, Pleasonton wrote: "If in your opinion it be not too late to erect the buildings this season, you will advertise for proposals without delay." If this proved to be impossible, Henshaw was authorized to have the work performed in the following year. On July 22, 1831, however, Henshaw signed a contract with Winslow Lewis to complete the work by November 15.[9]

Lewis' contract (see appendix G for the full text) called for structures that differed radically from those being replaced. The new lighthouse tower was to be a round brick structure 35 feet high with a diameter of 22 feet at the base. The keeper's dwelling at 26 by 28 feet was to have approximately the same dimensions as its predecessor, but was also to be constructed of brick. The well was to be in the cellar of the dwelling, while oil was to be stored in eight 90-gallon butts in the lighthouse. (In a brick building there was apparently less concern about fire.) Again, there was no mention of an assistant keepers' dwelling. The total cost of this project was $3,993—substantially less than the 1797 structures, even though Lewis' contract apparently included a new lantern. Unfortunately, this contract—like the previous one—does not contain any specifications about the location of the structures within the government tract.

Construction

The new complex seems to have been built as specified in the original contract. There is some uncertainty about the actual date of completion of the new complex, and some sources give a date of 1833.[10] However, Lewis' contract called for a completion date of November 15, 1831, and there is no evidence to suggest that he failed to meet this deadline. In addition, the compilation in the "Statement of Appropriations" indicates that $4,162.78 was expended in the year 1831.[11]

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[9] Contract Book E, Lighthouse Contracts, p. 259-262; RG 26; NA/DC.

[10] For example, see Holland, p. 83.

[11] Lighthouse Clipping File; RG 26; NA/DC.

Subsequent Development

As Pleasonton's unimaginative reign continued, Congress sought means of exerting influence on the management of the troublesome lighthouse establishment. In 1838 it passed an act that divided the country's lighthouses into eight districts, and that ordered a naval officer to report on conditions in each district. The report of Lt. Edward W. Carpender, the officer whose district included Cape Cod, seems to present an impartial and balanced summary of conditions as of November 1838 (App. H). The regular annual report of the superintendent, George Bancroft, dated August 10, 1839, presents a similar appraisal.[12]

An unexpected finding in the reports for this period is the fact that the Cape Cod Light was supplied with a boat. The surprise lies not in the provision of boats for lighthouses, which was common practice, but in the fact that one was thought to be needed at Cape Cod. Obviously a boat was essential at the many lighthouses that were located on islands; elsewhere, they were useful for carrying supplies, performing rescues, or fishing. However, the physical conditions at Cape Cod would seem to make the usefulness of a boat questionable. A boat stationed on top of the cliffs would have been of little value, yet at the base of the cliffs there would seem to be no reliable way to shelter one from the ocean. While some fishing is conducted in adjacent waters, the longshore current makes landing in the vicinity of the lighthouse hazardous.[13] Nonetheless, the 1839 annual report makes it clear that there was a boat associated with the light. It also explains its main function, stating that "it was damaged during a tempest last winter in attempting to board a vessel in distress." Before the creation of a separate lifesaving service, keepers often performed this function.

An 1846 report mentions a boat house, but since the reference pertains to the earth under the boat house being washed away, it confirms the problems associated with the location. It is possible that the slope of the cliff was somewhat different at that time, and there may have been a temporary shelf of land that made it possible to shelter a boat. While the general tendency is for the cliff to retreat, the process is irregular, so that the configuration of the slope at any given time varies. Photographs from the first part of the 20th century show that there was a wooden staircase leading down the cliffs to the beach, and other accounts mention that ocean bathing at the base of the lighthouse was possible.[14]

In the early 1840's, Cape Cod Light figured prominently in another of the periodic controversies that swirled around the lighthouse administration, and which generated a richly vehement documentary record to delight historians of the subject. After two decades in the same

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[12] Annual Report, 1839; Box 2; Annual Reports; RG 26; NA/DC.

[13] For example, the 1794 "Topographical Description" notes that "The eastern shore of Truro is very dangerous. More vessels are cast away here than in any other part of the county." (p. 197).

[14] Photographs and postcards in collections of Truro Historical Society and Cape Cod NS.

office, Pleasonton was coming under increasing fire. One of his most unsparing and persistent critics became I.W.P. Lewis, a nephew of Winslow Lewis.

The younger Lewis executed many lighthouse contracts before breaking decisively with Pleasonton, one of them to refit Cape Cod with a lantern of improved design. This design incorporated a Fresnel lens, which used triangular prisms to focus and thus increase light for navigational purposes. The project was completed in August 1840.[15] The old reflectors taken from Cape Cod were transferred to Norfolk.[16] In the following months, Pleasonton began to question the cost of the work done at Cape Cod, as compared with seemingly similar work performed by Winslow Lewis at Cape Henlopen.[17] This contributed to the progressive deterioration of relations between the 5th Auditor and the younger Lewis. It became apparent that the new lamps at Cape Cod consumed an excessive amount of oil—in Pleasonton's eyes an indictment of the utmost severity. Late in 1842 Pleasonton ordered the removal of the new lamps and their replacement by the former Argand type. After a test by the captain of the lighthouse service's cutter showed "no perceptible difference in the brilliancy of the lights," Pleasonton could scarcely conceal his glee when informing the Secretary of the Treasury.[18]

This seemingly calculated affront must have been a factor in precipitating the final split between Pleasonton and I.W.P. Lewis. In that era of exaggerated sensitivity to any suggestion of criticism, the issue became thoroughly personalized and was soon absorbed into the perpetual partisan political battles. Since the participants were both articulate and possessed of an easily wounded vanity, some marvelous polemics ensued.

As a result of this political maneuvering, I.W.P. Lewis was ordered to prepare a report on the lighthouses of Maine, New Hampshire, and Massachusetts. He seized this opportunity to retaliate and produced a scathing condemnation of Cape Cod Light, which had been built by his uncle only about 10 years before (see Appendix I). This constituted another direct assault on Pleasonton's administration of the nation's lighthouses. Lt. Carpender had observed some of the same defects during his examination three to four years earlier, but the tone of his report is less severe. The annual report for 1839 also does not portray matters in the catastrophic condition claimed by Lewis, although it is possible some of the structural flaws may not have been easily visible. This leads to the conclusion that Lewis exaggerated the defects to make a stronger case for his side of the larger controversy.

An unusual aspect of the dispute as it developed at Cape Cod was the involvement of the keeper, Jesse Holbrook. He became an ally of I.W.P. Lewis, and Lewis responded by

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[15] I.W.P. Lewis to Pleasonton, August 18, 1840; Correspondence; RG 26; NA/DC.

[16] George Bancroft, Superintendent of Lights, Boston, to Pleasonton, October 20, 1840; Correspondence; RG 26; NA/DC.

[17] Pleasonton to Bancroft, January 25, 1841; Letters Sent, vol. 16; RG 26; NA/DC.

[18] Pleasonton to Walter Forward, Secretary of Treasury, February 23, 1843; Letters Sent, vol. 18; RG 26; NA/DC.

recommending that, in view of "the remote location," Holbrook's salary be increased from $350 to $500 annually.[19] Holbrook resisted the changeover to the old-style lamps, at one point even writing directly to the Secretary—surely an unusual expression of independence on the part of a lighthouse keeper. Learning of this, Pleasonton concluded that he was "acting under the influence of I.W.P. Lewis," and as a result was "not disposed to do justice to the present lamps." Since Cape Cod was "one of the most important lights on the Eastern Coast," Pleasonton requested the Secretary to remove Holbrook.[20] It appears that Holbrook was, in fact, removed soon after and replaced by James Small, son of the first keeper.[21]

Pleasonton survived the challenges of the early 1840's, but by the end of the decade his position was under renewed attack. Furthermore, the recent acquisition of California and the continuing growth of the nation's maritime traffic simply increased the scale of the problem. This time his foes were more determined and persistent. As will be explained in the following chapter, they finally succeeded in bringing an end to his 30-year reign.

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[19] I.W.P. Lewis to Secretary of Treasury, February 6, 1843; "Lighthouse Letters, Series P," 1843-1864, Series 35; RG 26; NA/DC.

[20] Pleasonton to John C. Spencer, Secretary of Treasury, May 15, 1843; Letters Sent, vol. 18; RG 26; NA/DC. The frequent turnover of Secretaries was probably a factor in Pleasonton's durability.

[21] Lighthouse annual reports for 1845-1847 list "E. Small" as keeper, although the 1849 report states that James Small was appointed "six years ago." The reasons for this discrepancy are not known.

THE THIRD (PRESENT) CAPE COD LIGHT

Administrative Background

In 1851 Congress appointed a board, composed largely of military men, to conduct a thorough study of American lighthouses. This board examined every aspect of lighthouse technology, operation, and administration. In the words of the best-known modern student of lighthouses, "It is doubtful that any agency prior to that time, or perhaps subsequently, went through such a searching inspection."[1] The result was a massive report of 760 pages, plus numerous appendices. While avoiding explicit condemnation of Pleasonton, the board left no doubt that only a complete overhaul of the lighthouse establishment could bring it into the modern era.

Congress, armed with the report of the 1851 investigative board, at last had the ammunition it needed to overthrow Pleasonton. Indeed, the board had presented its findings in such stark terms that Congress could no longer avoid reforming the lighthouse establishment. The board conveniently provided a blueprint for reorganizing the lighthouse administration, which Congress readily followed. On October 9, 1852, it created a permanent nine-member Lighthouse Board, again with a preponderance of military officers. As in the case of the investigative board, these members had outstanding reputations in their fields, with most of the military men representing technical branches of the services.

For the first time in the more than 60 years of federal control of aids to navigation, a systematic approach took place. Aids to navigation were planned as part of a coherent system, based on the needs of the nation's maritime traffic. In a striking example of this new method, Lt. George C. Meade—later the Union commander at Gettysburg—examined the lights on the southern approach to New York harbor. He concluded that Barnegat was properly a coastal light and should be considered more important than the old light at Sandy Hook. As a result, Barnegat was relocated several hundred feet and rebuilt to become the dominant light in the vicinity.[2]

The Lighthouse Board conducted a sweeping campaign to modernize the nation's lighthouses in its first years. During this period, a majority of American lighthouses were rebuilt or substantially altered, following a methodical program. Many lighthouses that had been associated with Cape Cod historically or functionally—among them Baker's Island, Thatcher's Island, Plymouth, Gay Head, and Fire Island—were rebuilt and refitted during this energetic period. Cape Cod Light itself was included in this plan, having been placed 31st on the "List of existing sea-coast lights which require

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[1] Francis Ross Holland, Jr., *America's Lighthouses* (Brattleboro, VT: The Stephen Greene Press, 1972), p. 34.

[2] Holland, *America's Lighthouses*, p. 94.

to be elevated, and to be refitted with first-order lens apparatus."[3] As this report indicates, resistance to the Fresnel lens disappeared with Pleasonton, and its use became routine.

The Need for a New Light

The relationship of lighthouses to one another became an important factor under the new system in determining their location and physical characteristics. This approach brought the location of the Cape Cod Light under close scrutiny after some 60 years in essentially the same location. Serious dissatisfaction with the second Cape Cod Light was evident as early as 1852, when it was recommended "to elevate, improve, and fit with first-order illuminating apparatus the light-house at Truro highlands, Cape Cod, being an important seacoast position to mark the approaches to Boston bay" for $15,000.[4]

An 1853 entry recommended that the Cape Cod Light be moved to higher ground to the south of its current location, because that same high ground blocked its visibility to mariners approaching from a southerly direction.[5] It was said that "the present light is not seen in approaching it from the south over hills, woods &c which are situated a short distance to the south of it."[6]

In addition, the Lighthouse Board was hopeful that moving the Cape Cod Light would permit the closing of the triple beacon at Nauset, in Eastham. This was a group of three separate lighthouses known as the "Three Sisters," whose maintenance struck the efficiency-minded board as wasteful. The board believed that if the Cape Cod Light were moved to the south, it would cover the entire eastern face of Cape Cod, making the three Nauset lights unnecessary. Once again, erosion was not cited as a reason for rebuilding the light.

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[3] Report of the Light-House Board, January 30, 1852, in *Compilation of Public Documents and Extracts from Reports and Papers Relating to Light-houses, etc., 1789-1871* (Washington: GPO, 1871), p. 710.

[4] From Annual Report of Lighthouse Board (Annual Report), 1852; Lighthouse Clipping File, Cape Cod., Mass. (Clipping File); RG 26; NA/DC.

[5] From Annual Report, 1853; Clipping File; RG 26; NA/DC.

[6] March 28, 1856; Vol. 3; Journal of the Light-House Board, May 20, 1851-Jan. 1, 1908, Series 1 (Journal); RG 26; NA/DC.

Site Selection

General Location

Congress, responding to the dissatisfaction, appropriated $25,000 on August 3, 1854, "for the removal of the light-house at Truro (Highlands), Cape Cod, to a proper site, and for fitting the same with the most approved illuminating apparatus, and to serve as substitute for three lights at Nausett Beach."[7]

For a time, a substantial change in the location of the Cape Cod Light seemed assured. In February 1855, Massachusetts ceded jurisdiction over additional land in Truro that the federal government might wish to use for lighthouse purposes.[8] The Lighthouse Board voted on March 28, 1856, to give the following instructions to its agent, Major C.A. Ogden, Corps of Engineers, Boston, 2nd District:

> On motion it was ordered that Major Ogden be requested to enter into negotiations with the owner of the land for the new Lighthouse authorized to be built on the Highlands Cape Cod, in place of the present one. - That Major Ogden be informed that the design of the law is to erect a 1st class light on the most elevated and suitable site to the south of the present lighthouse at Cape Cod highland (Truro) to subserve all the purposes now derived from the present light, and the three beacon lights at Nausett Beach, but that the primary object to be attained in the establishment of a 1st class sea coastlight - to be visible within the limits of the range of the height above sea level - north and south - to guide vessels in approaching the coast from seaward and coasters and other from the direction of nantucket and from the eastward (Boston Bay &C) - It is the wish of the board that the site may be selected with great care and with reference to the benefits to be conferred on mariners, as well as to the proper stability and protection of the tower and buildings. - If major Ogden has any doubt as to the position referred to in his letter of 5th July 1855 to the board, he is recommended to make a further examination of the coast line between the present Lighthouse at Truro and the Nausett Beacons and avail himself of the nautical knowledge of the inspector of the district, who, if desired, will be instructed to accompany him in making further examinations. - The complaint is that the present light is not seen in approaching it from the south over hills, woods, &c which are situated a short distance to the south

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[7] Clipping File; RG 26; NA/DC.

[8] Box 86; Lighthouse Site Files, Series 66 (Site Files); RG 26; NA/DC. A "site for a Light House at Truro:Highlands:Cape Cod" was included with a number of other cessions needed to carry out the board's modernization program.

> of it and that on top of one of those hills will be the best site for the light to meet all of the wants of the navigator. - The elevation of the base of the present tower above the level of sea is, according to the information in this office 135 feet and the present tower 36 feet high making 171 ft for the elevation of the light giving a range of 21 nautical miles. - It is believed that an examination of the coast south - with a good telescope from the top of the present light house will facilitate in determining the particular hill or elevation which obstructs the view of the mariner in approaching it from that quarter. A light of equal elevation to the present one placed on the elevated point indicated would no doubt be seen ten or twelve miles beyond the present Nauset beacons. - The board is very desirous of having the necessary quantity of land purchased (depending upon the price asked per acre) and the deeds prepared title investigated for so the work may be done this summer.[9]

It should be noted that the Lighthouse Board spoke decisively of entering into negotiations with the "owner of the land for the new lighthouse authorized to be built on the Highlands, Cape Cod, in place of the present one"; it did not request him to determine *if* a new location was desirable.[10] The documentation indicates that a sum of $1,100 may have been associated with this work (of which $37.71 was eventually repaid).[11]

The search for a new site continued through the spring and into the summer. Its progress is somewhat difficult to follow, because most of the letters sent to the Lighthouse Board during this period have apparently not survived, even if they were subsequently bound into letter books. Fortunately, their receipt is recorded in the board's letter register. A typical entry in the register would include the name of the sender, the date the letter was written, a brief statement of the letter's subject, and possibly the location of the letter in a later bound volume. Thus, it is known that the Lighthouse Board received a letter from A.A. Humphreys dated April 23, 1856, on the subject, "Respond rel to site of light house" [at Highland Light?][12] A letter dated May 5 records that the board received tracings of Cape Cod from Major Ogden.[13] The board's journal entry from May 21 supports the letter register as follows: "From Major Ogden Corps Engineers May 5 in relation to the removal of the lighthouse at Cape Cod Truro. - send a tracing of the survey of the locality.

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[9] March 28, 1856; pp. 310-311; Journal; RG 26; NA/DC.

[10] Vol. 3; Journal; RG 26; NA/DC. If the board had a specific piece of property in mind, no reference has been found.

[11] March 28, 1856; pp. 310-311; Journal; RG 26; NA/DC.

[12] A.A. Humphries, Ast. Chm. Comt., April 25, 1856; letter book no. 11, p. 241; Letters Received from District Engineers and Inspectors, 1853-1900, Series 24 (Letters Received); RG 26; NA/DC. [From the Letter Register.]

[13] C.A. Ogden, Major, Corps. Engrs., May 5, 1856; letter book no. 29, p. 585, with three enclosures; Letters Received; RG 26; NA/DC. [From the Letter Register.]

- Referred to the Committee on Lighting."[14] A later entry recorded that "the committee on lighting reported in relation to the proposed lighthouse for Cape Cod - Truro as to site range &c."[15] Ogden's tracings have not been located, nor have other specific letters from this same time period.

By mid-August, however, the Lighthouse Board appears to have decided to build the new lighthouse on the same property as the second lighthouse. The first indication of this is contained in an August 15 letter from Engineer W.B. Franklin of the 1st and 2nd Districts (Maine and Boston), in which he speaks of shipping materials and men for the construction of the Cape Cod Light House.[16] The board officially reversed its March 28 vote on September 3, having determined that a lighthouse on the existing government tract would be adequate.[17] The board's journal for that date reads as follows:

> On motion it was ordered that the works for which special appropriations have been made heretofore including those embraced in the lighthouse bill of Aug 18, 1856 to be put in [?] for an early commencement and speedy completion viz Cape Cod Highland Truro Mass. New tower to be erected near the point in a substantial manner for a first order lens, fixed light. On the land belonging to the US at that station and the tower be sufficiently high if the approp will admit of it to be seen above the trees and hills to the southward of it. The work to be commenced at the earliest possible moment.[18]

Presumably this conclusion was based on examinations of the area conducted over the spring and summer by Major Ogden and others.[19] The board did not explain its decision, but it seems reasonable to suppose it had concluded that increasing the height of the light, in conjunction with the much greater brilliance of the Fresnel system, would overcome the objections to the old light.

The board's decision to rebuild the light on the same property as its predecessor was also in keeping with common practice of the day. Relatively few lighthouses in the region are the original

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[14] May 21, 1856; vol. 2, p. 329; Journal, 1856-57 (Series E-1); RG 26; NA/DC.

[15] June 2, 1856; vol. 2, p. 338; Journal, 1856-57 (Series E-1); RG 26; NA/DC.

[16] Engineer Franklin, Boston, MA, 2nd District, August 15, 1856; letter book no. 47, p. 12; Letters Received; RG 26; NA/DC. [From the Letter Register.]

[17] September 3, 1856; vol. 3, p. 353; Journal; RG 26; NA/DC.

[18] See footnote 17.

[19] An exhaustive search has failed to locate the reports of Major Ogden or others. It appears that these reports were transmitted only as letters and never published in any other form. The originals were probably destroyed in one of the catastrophes that befell lighthouse records before they were placed under the custody of the National Archives.

structure on the site; many are the product of the massive reconstruction program undertaken in the early years of the Lighthouse Board. On the other hand, most lighthouses were rebuilt in close proximity to their predecessors, with temporary beacons being used to avoid an interruption in lighting. The small light on Brant Point, Nantucket, which has been rebuilt six times on essentially the same site since its establishment in 1746, carries this tendency to an extreme.[20] It would have been quite exceptional if the Cape Cod Light had been moved, as originally planned, to a new site a mile or more away. The Portsmouth (NH) light was rebuilt about 1,000 feet from the one it replaced in 1877, and that represented about the limit of customary change.[21]

Major relocations required an extensive process of notification of mariners. Even then some element of risk remained for those such as whalers who had been gone for an extended period and returned to changed conditions. Safety factors such as this contributed to a conservative outlook among lighthouse administrators, whatever their organizational affiliation. On a more prosaic note, the government frequently found the acquisition of private land and relations with private neighbors to be troublesome, and may have wished to keep such transactions to a minimum.[22]

Specific Location

The government's 10-acre tract on the Highlands permitted the relatively small shifts in location that were typical of lighthouses historically, but not much more. It appears as though the third lighthouse was built not only on the same property, but also on almost the exact same spot as the second lighthouse. As mentioned in connection with the second lighthouse, an 1848 map (fig. 1) shows the second tower and second keeper's dwelling in the same approximate locations as the present structures.

Additional information is provided by an illustration published in 1856 in a popular magazine of the day (fig. 2). As will be explained in the following section, this illustration was drawn after the construction of the third keeper's dwelling, but before the construction of the third tower. The third dwelling and the second tower in this illustration display the same relationship to one another that the third dwelling and the third tower do today. However, there may have been a very slight relocation when the third tower was built. This is based on the fact that the connecting buildings between the present-day dwelling and tower do not run in a straight line (see app. A).

The fact that the Lighthouse Board again chose to rebuild the lighthouse on the same property—even though it was empowered to go elsewhere if necessary—indicates that the board was not overly concerned about the erosion observed by Thoreau during his visits to the site. As

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[20] Malcolm F. Willoughby, *Lighthouses of New England* (Boston: T.O. Metcalf, 1929), p. 173.

[21] Holland, *America's Lighthouses*, p. 79.

[22] The old light at Brant Point, Nantucket, later provided a conspicuous example. [Edward Rowe Snow, *The Lighthouses of New England* (New York: Dodd, Mead, 1973), p. 274.]

described in connection with the second lighthouse, Thoreau had commented on the wasting of the cliff, probably because he was fascinated by the transient character of Cape Cod geography, and perhaps also by human efforts to impose permanence on it. He concluded that the lighthouse would have to be moved "erelong," but his estimate of the rate of erosion (6 feet per year) is much higher than the historical average. The board's decision to rebuild the light on the same property indicates that it was prepared to accept the actual, observed rate of erosion.

Construction

Early Expenditures

The financial records are confusing concerning the construction dates of the third lighthouse and its associated buildings. A sum of $7,655.54 was expended in 1855 relative to the 1854 Congressional appropriation to rebuild the light.[23] However, the specifics of the expenditure are not clear. The only surviving archival entry from 1855 is as follows: "*Removal of light-house at Truro, (Highlands) Cape Cod.* - The subject of the new location is under the consideration of the Light-house Board."[24] The expenditure of $7,655.54 seems excessive for the purposes of "consideration," even if it included activities such as planning and surveying, and related salaries and travel.

Thorough investigation of the documentary record provided no clue to the use of this money. For example, *The Boston Daily Advertiser*, a newspaper of the period that contained maritime news, was scanned thoroughly for the years 1855 through 1858. While changes to other lighthouses, including construction of temporary towers, were recorded in the paper's "Notices to Mariners" section, none were found for Cape Cod (Highland) Light.

The 1855 expenditure, however, could not have been for the construction of the lighthouse tower. The 1856 magazine illustration (fig. 2) shows that the second lighthouse was still extant. However, the same illustration shows that the new keeper's dwelling for the third lighthouse had been built by that time. It is thus tempting to ascribe the 1855 expenditure to the construction of the third keeper's dwelling.

A careful study of two historical documents, however, indicates that the third dwelling was not built until 1856. The first document is an article that appeared in the Barnstable *Patriot* on

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[23] Clipping File; RG 26; NA/DC.

[24] Annual Report, 1855; Clipping File; RG 26; NA/DC.

December 4, 1855.[25] The article, written by a "Mrs. Margery Daw," proves that the second keeper's dwelling was extant and in poor condition at that time:

> We were all seated cozily at dinner. The Squire on my right, Mr. Hall on my left, Mrs. Small opposite and next to her a young lady, who I may call the light of the Light House, with little boy Small on the other side of his mother's wing, when just as the hostess had put her fork into as plump a fowl as ever crowed, there came a rattle, a crash, smash and cloud of dust which rendered all on the opposite side of the table invisible to me.
>
> My first impulse was to look down, and lo! and behold what a sight! The fowl, the squash, the potatoes, the beets, the cabbage, the bread and the pumpkin pie were covered with fragments of mortar and plaster. The castors [?] only stood above the heap of rubbish, like flowers over the ruins of...[word indistinguishable] running from this melancholy spectacle. I looked up and lo! the cause of the catastrophe! a part of the ceiling had fallen down over our devoted board and heads. It was not the first time the ceiling had acted so, I was told, as on a former occasion it had descended and Mrs. Small had patched the chasm with a newspaper.

The second document is a request made in March 1856 to use a room in the keeper's dwelling as a telegraph office.[26] It is possible that this request sought a room in the new keeper's dwelling: a room in the old keeper's dwelling was *already* being used as a telegraph office at that time, and there would have been no need of the March 1856 request unless it pertained to the third dwelling. There had been a telegraph office at the site since December 1855.[27] It is known to have been located in the second keeper's dwelling, based on Mrs. Daw's *Patriot* article of December 4, 1855, which also included the following:

> As we sat chatting about the probability of Provincetown one day becoming an island, and of its harbor being destroyed for want of a little care to prevent the sea breaking through in one particular part, -a circumstance

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[25] Mrs. Margery Daw, "Light From A Light House"; written November 20, 1855; published in the Barnstable (MA) *Patriot*, December 4, 1855, p. 1.

[26] Letter book no. 41, p. 342; Letters Received; RG 26; NA/DC. This letter book, like many of the bound volumes of letters from the period, has not survived. As stated previously, the Letter Register of the Lighthouse Board records the former existence of many of the letters. Another such record is two boxes of index cards in the National Archives in Washington, D.C., which contain references to missing letters and a brief description of their contents. These boxes are called the Index Card Finding Box, hereinafter called the "Finding Box."

[27] A Yarmouth (MA) *Register* article dated December 14, 1855, reported that the Cape Cod Telegraph was completed, and that a station "had been opened at Highland Light."

> which Captain Small considers by no means improbable- and of Beach Point being gradually washed away, and of other such matters, I heard all at once a very curious and inexplicable sound. If I had been a believer in Spirit Rappings I should have perhaps imagined that the ghosts of one or other of my departed three husbands had left their particular spheres to visit me, [I must candidly say, I'd rather have them near me in the spirit than in the flesh] but as I have no faith in such tom-foolery, I at once sat down the noises to natural causes- of course I was right . . .
>
> "Click--click--cli-cli-click," on it went - and Mrs. Small seeing me somewhat surprised, observed by way of explanation: "It's the Telegraph- the office is in the next room- let us go and I will introduce you to the operator."
>
> So in we went and lo! and behold there was a queer little brass machine close to the window, with wheels and springs and cylinders with coils of wires round them- and a slip of white paper, like a doctor's bandage, running from one hole in the stand into the machine and from it into another little hole; and there were wires coming in through the window. . . .[28]

Therefore, the third keeper's dwelling was not built until 1856, and so could not have been the cause of the $7,655.54 expenditure in 1855.

Construction of the Keeper's Dwelling

The main keeper's dwelling was erected in 1856, prior to the third lighthouse tower and assistant keepers' dwelling. This is based on two sources. The first is the Annual Report for 1856, which states that "a new dwelling has been built for the keeper at the Cape Cod Highlands light-house . . . ."[29] The report does not mention a new lighthouse or an assistant keepers' dwelling. The second is the 1856 magazine illustration (fig. 2). It depicts a keeper's dwelling very similar to that constructed in 1856, with window and doorway openings in exactly the same locations. There are only two differences. The artist drew eared window lintels, a hallmark of the Gothic Revival and Italianate styles, instead of the slightly pedimented lintels that were actually installed. (Artistic license could be blamed). Second, the illustration shows the doorway on the south elevation leading directly from the interior of the house to the exterior. This doorway is in the same location as the extant doorway that currently leads into the brick connecting building, and is therefore not a real difference.

The 1833 keeper's dwelling may have been ready for demolition in mid-1856. Requests were made in June and July of that year to remove heating apparatus and the telegraph office, respectively,

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[28] Daw, "Light from a Lighthouse."

[29] Annual Report, 1856; Clipping File; RG 26; NA/DC.

from somewhere on the site.[30] These requests almost certainly relate to the old keeper's dwelling—it is the only structure that would have had a heating system, and it is known to have contained the telegraph office.

Construction of the Lighthouse and Assistant Keepers' Dwelling

As stated previously, the 1856 illustration (fig. 2) shows the buildings on the site at that time to have included the new keeper's dwelling. Also depicted are a freestanding outbuilding and the 1833 lighthouse. It is assumed that the outbuilding is the barn. It is not certain if this is the barn that was constructed on the site in 1797. However, it does appear to be the same outbuilding that appears in the earliest photographs of the site. The lighthouse shown in the illustration is clearly the 1833 tower, since it is radically different from the extant tower. (The differences are far too great to attribute them to artistic license.)

Preparations for the construction of the lighthouse tower continued through 1856. An undated drawing found in Coast Guard archives is entitled "Design for Light House Tower at the 'Highlands, Truro, Cape Cod'" (fig. 3). It includes balcony- and ground-floor plans, and a vertical section through the center of the tower. This drawing may have been a generic design that was being evaluated for use at Cape Cod; it might even have been a first proposal for construction. In either case, it closely resembles the tower as actually constructed. The only differences are in the ground-floor plan, concerning the relationship between the tower base and the covered walkway to the assistant keepers' dwelling. (The design of the stair to the tower's upper decks is also different from what exists today, but the documentation shows that the original stair was later replaced.) Other records show that a drawing of the proposed new tower existed by December 10,[31] and that plate glass for the entry was delivered by December 23.[32]

The letter register records the receipt of a September 9, 1856, letter from Engineer Franklin regarding the transmittal of the estimate of funds required for the removal of the lighthouse at Cape Cod, Highlands of Truro.[33] In the absence of the actual letter, the nature of this "removal" work is unclear; it may refer to the anticipated demolition of the second lighthouse tower.

Actual construction of the tower, the assistant keepers' dwelling, and the passages connecting them to each other and the main keeper's dwelling took place in 1857. On April 15, Franklin

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[30] Letter book no. 41, p. 475, and no. 48, p. 27; Letters Received; RG 26; NA/DC. [These volumes have not survived; the information is from the Clipping File.]

[31] December 10, 1856; letter book no. 47, p. 50; RG 26; NA/DC. [From the Finding Box.]

[32] December 23, 1856; letter book no. 47, p. 74; RG 26; NA/DC. [From the Finding Box.]

[33] Engineer Franklin, Boston, MA, 2nd District, September 9, 1856; letter book no. 47, p. 21; Letters Received; RG 26; NA/DC. [From the Letter Register.]

transmitted a special estimate for building the Cape Cod lighthouse.[34] One somewhat unreliable source says that "a light was displayed from a temporary structure near the edge of the cliffs" while the construction of the new light was in progress.[35] In October, two letters were sent to Franklin by N. Libby from Highland Light. An excerpt from the first includes the following: "I think that we shall finish up by the 20th if the weather is as good as it has been for two weeks."[36] The second reveals: "As we shall finish all up this week ready to leave for home I shall need as near as I can ascertain a $1000 or $1200 to pay up all bills."[37] An Annual Report entry confirms that "*Cape Cod light-house* has been rebuilt and a first-order lens placed and lighted. Two houses for assistants have been built."[38] Expenditures for work in 1857 exceeded $17,000.[39]

The relationship of the various structures at the close of 1857 was as follows: the tower and the principal keeper's dwelling were joined by one passage, with a second passage running perpendicularly from the first to the assistant keepers' dwelling.

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[34] Engineer Franklin, Portland, ME, 1st & 2nd Districts, April 15, 1857; letter book no. 47, p. 97; Letters Received; RG 26; NA/DC. [From the Letter Register.]

[35] Isaac M. Small, "Highland Light, This Book Tells You All About It" (Provincetown, MA: The Advocate Press, Howard Hopkins, 1891), p. 5.

[36] N. Libby to Capt. W.B. Franklin, Portland, ME, October 11, 1857; Lighthouse Expenses 1850-1900 (Expenses); Miscellaneous Materials Received by 5th Auditor 1792-1855, series 45 (Miscellaneous Materials); RG 26; NA/DC. [Note: the "Lighthouse Expenses" folder appears to have been misfiled in series 45.]

[37] N. Libby to Franklin, Secy. of the Lighthouse Board, Washington, October 14, 1857; Expenses; Miscellaneous Materials; RG 26; NA/DC. Engineer Franklin was also a Secretary of the Lighthouse Board, and so resided at least part of the time in Washington, D.C.

[38] Annual Report, 1857; Clipping File; RG 26; NA/DC.

[39] "Statement of Appropriation, &c.," March 4, 1789-June 30, 1882 [published 1886]; Clipping File; RG 26; NA/DC.

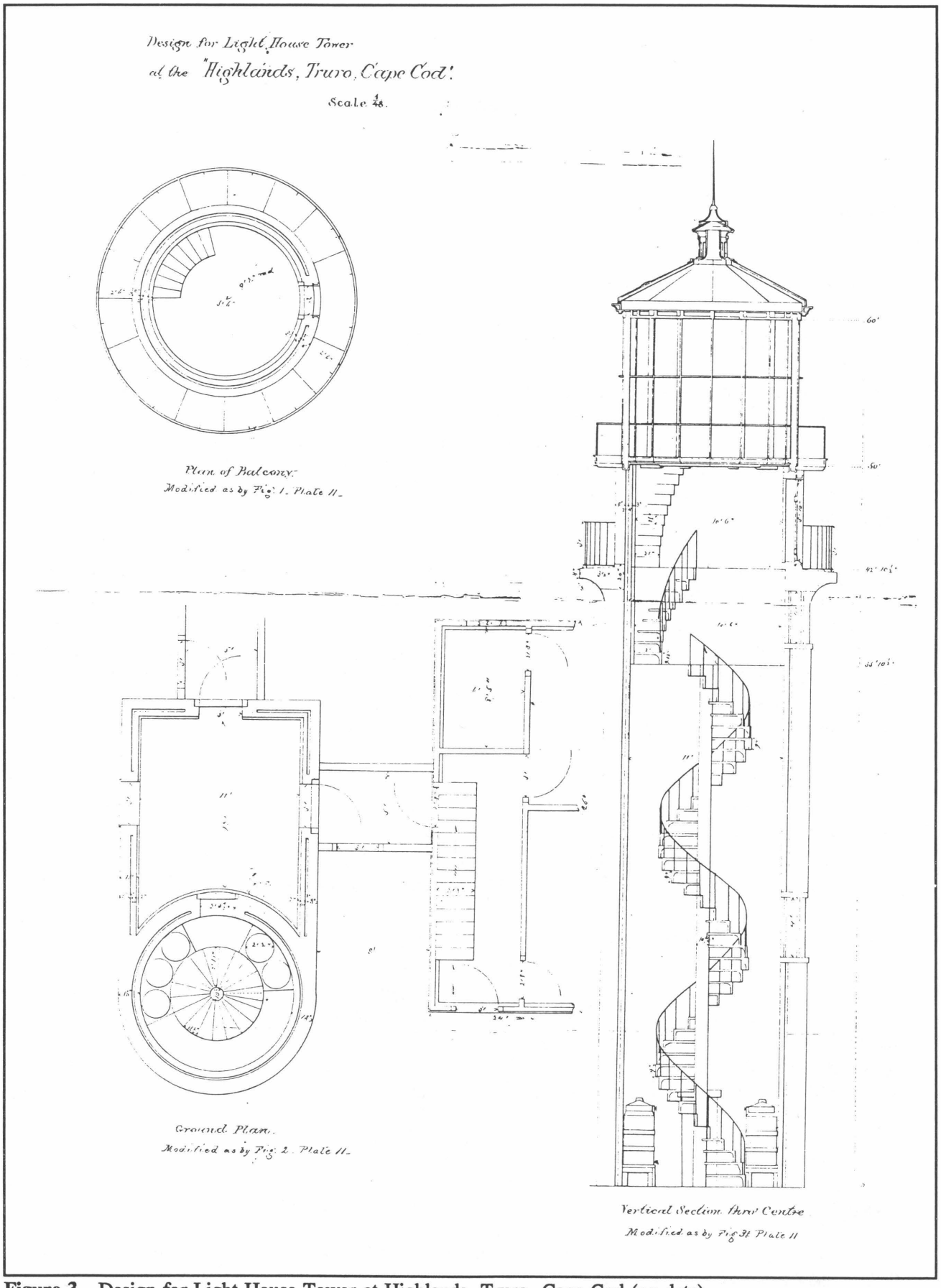


Figure 3. Design for Light House Tower at Highlands, Truro, Cape Cod (no date).

Subsequent Development

1857 to 1898

The Role of the Lighthouse Board

The Lighthouse Board, which had been established in 1852, continued to administer aids to navigation through the remainder of the 19th century. The surge of modernization activity in the 1850's was soon followed by the massive rebuilding of southern lighthouses after the Civil War. After that, the Lighthouse board settled into an efficient routine. As a quasi-military entity, it sought to establish bureaucratic regularity in the management of its far-flung system. Following military precedent, the country was divided into 12 districts, each with a naval officer serving as inspector and with a military engineer. This continued policies of the previous lighthouse administration, but on a more systematic basis.

As will be explained subsequently, the number of lighthouses increased dramatically in the second half of the 19th century. Under these circumstances, and with continued pressure toward standardization, the individuality of any one lighthouse diminished. Each light's equipment and function was determined by its role within the overall system. The formation of a unified lighthouse service with highly regulated personnel management was a contributing factor. (Lighthouse keepers were placed under the Civil Service system in 1896, bringing an end to the long period of political interference, with its widely variable results.)[40]

Despite the movement toward more systematic management of lighthouse affairs, it was still possible for local interests to make their needs felt through formal channels. In 1872, for example, the Light-House Engineer for the district in which Cape Cod was located noted that "The merchants and ship masters of Boston are also desirous of having an efficient fog signal at Cape Cod Light House and at Race Point also. If however they can have but one they would prefer the former."[41]

Activity at the Highland Light

Documentation has shown that at least three Highland structures were built prior to the close of 1857: the lighthouse, the keeper's dwelling, and the assistant keepers' dwelling, which was a duplex dwelling for two assistant keepers. The light was equipped with a first-order fixed Fresnel lens. Either at the same time or shortly thereafter, covered walkways were constructed connecting the dwellings to the lighthouse. The exterior details of the main keeper's dwelling were slightly

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[40] Holland, *America's Lighthouses*, p. 40. There must have been some reluctance to surrender this "plum," since the major Civil Service reform act had been passed in 1883.

[41] Light-House Engineer, 1st and 2nd District, Portland, ME, to 2nd District Engineer; letter book no. 297; Letters Received; RG 26; NA/DC.

different than those of the assistants' dwelling, although both were finished with vertical board-and-batten siding. The main keeper's house was trimmed with slightly pedimented lintels over doorway and window openings. All of the window openings visible in early photographs, except foundation openings, contained six-over-six double-hung sashes, including the openings in the tower below the lantern level. While both the tower and the small connecting structures were built of brick, only the tower was whitewashed; the connectors were painted to match the dwellings. The roofs appeared to be covered with wooden shingles or shakes.

A property survey conducted in 1885 (see fig. 10) shows that the location of the three structures was as close to the west property line as possible, and near the south corner. This site selection was no doubt based on the need to keep the buildings as far away from the eroding cliffs as possible, so the necessity for relocating or rebuilding the structures would be postponed for as long as possible.

Repairs were performed at the site as early as the end of 1857 and throughout 1858. An inspector reported on the condition of the cisterns, the specifics of which may be lost.[42] Entries from May and June 1858 show that repairs of some type were required.[43] The letter register from August shows that the repairs at the "lighthouse, Cape Cod - Highlands of Truro" were completed.[44] The nature of those specific repairs are unknown.

On October 23, 1858, the "old Lanterns of Nauset L.H." were transferred to Cape Cod (Highlands).[45] As explained previously, the Lighthouse Board in 1856 intended for the new Highland Light to take the place of not only the earlier Highland Light, but also the nearby "Three Sisters" lighthouses at Nauset Beach. These had been constructed in 1838.[46] However, the removal of the three lighthouses' lanterns in October 1858 was not in preparation for their demolition; instead, they were outfitted with sixth-order Fresnel lenses that very same month.[47] Therefore, the reason for transferring Nauset's old lanterns to Cape Cod (Highland) Light is unknown; no instructions for their disposal were found.

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[42] Inspector Smith, December 10, 1857; letter book no. 69, p. 211, with one enclosure; Letters Received; RG 26; NA/DC. [From the Letter Register.]

[43] "Chart of repairs as necessary, May 26, 1858"; letter book no. 62, p. 154. "Repairs will be commenced on, June 18, 1856"; letter book no. 62, p. 149; RG 26; NA/DC. [From the Finding Box.]

[44] W.L. Dearborn, Clerk of Works, Boston, MA, 2nd District, August 16, 1858; letter book no. 62, p. 138; Letters Received; RG 26; NA/DC. [From the Letter Register.]

[45] October 23, 1858; letter book no. 62, p. 123; Letters Received; RG 26; NA/DC. [From the Letter Register.]

[46] A. Berle Clemensen and William W. Howell, with H. Thomas McGrath and Elayne Anderson, *Historic Structure Report - Three Sisters Lighthouses, Cape Cod National Seashore, Massachusetts* (Denver Service Center: U.S. Department of the Interior, National Park Service, 1986), pp. 11-12.

[47] Clemensen, Howell, McGrath, and Anderson, p. 16.

Cape Cod (Highland) Light was photographed as early as 1859, when the documentation shows that such photographs were transmitted.[48] Figures 4 and 5 may date to that time: they show the keeper's dwelling with its earliest vertical board-and-batten siding. Two other historic photographs (figs. 6 and 7) also show the board-and-batten siding. However, Ross Holland attributes the 1859 date to figure 4, a copy of which he located in the National Archives.[49] This photograph is very clear. It shows the whitewash on the foundation of the keeper's dwelling and the tower, the same dark paint color on the brick connecting passageways and the frame dwellings, and the lantern deck and catwalk appearing as though they were unpainted or painted in a light color. The only original exterior paint remaining on original building fabric was found on a basement window frame, at the north end of the west side of the main block of the keeper's dwelling. This opening had been covered during the later relocation of the main entrance, and so had been protected from subsequent alterations. The frame's paint sample showed that the original finish (and at least one additional finish) was a dark brick-red color, which probably is the color seen in all four early photographs.

Other repairs were completed in 1865, the nature of which are unknown.[50] Additional maintenance and alterations, but no new construction, occurred in 1868 and 1869, based on National Archives clipping file entries. The first entries from 1868 appear to relate to the dwellings. The roof valley was releaded and the shingling was renailed. This shingling was probably roof shingling, since the dwellings were sided with vertical board-and-battens and the lighthouse was brick. However, it is not known if this roof repair occurred on one or both of the dwellings. The "saddle-boards" and window frames were packed with paint cement, and the storm doors were repaired.[51] (The derivation of paint cement was not found, but a publication dated 40 years later suggests that zinc dust or a combination of zinc oxide and fine Paris white, mixed with "33 degrees Be waterglass," could form a waterproof putty that became hard in 6 to 8 hours.[52]) Perhaps paint cement was some sort of putty that was used as a type of weatherstripping, and which contained paint pigment as an ingredient.

Also in 1868, the floor of the covered walk was repaired. One chimney received an arched top in place of a blown-off ventilator. Also, call-bell fixtures were set. Later references indicate that a call-bell system existed between the dwellings, and between the lighthouse and dwellings. Three rooms were papered, but the specifics of location are unknown.[53]

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[48] February 14, 1859; letter book no. 62, p. 93; RG 26; NA/DC. [From the Finding Box.]

[49] Holland, *America's Lighthouses*, p. 82.

[50] September 7, 1865; letter book no. 180, p. 102; RG 26; NA/DC. [From the Finding Box.]

[51] Annual Report, 1868; Clipping File; RG 26; NA/DC.

[52] The Painters Magazine (New York), *739 Paint Questions Answered*, 2nd ed. (London: The Trade Papers Publishing Co. Ltd., 1904), p. 32.

[53] Annual Report, 1868; Clipping File; RG 26; NA/DC.

The newly arched chimney top may be that visible on the west chimney of the assistant keepers' dwelling in figure 4, which would date the photograph to no earlier than 1868. The less-sharp image in figure 5 also appears to show the same chimney lacking a ventilator. Figure 6 depicts an additional ventilator missing from the main chimney of the keeper's dwelling, suggesting the photograph was taken at a later date than figures 4 and 5. Figure 7 shows that all ventilators had been removed, putting it last in the chronological sequence of all four photographs. It is believed that the later two photographs also show the brick-red painted finish on the dwellings and connector buildings, but the color may be faded in figure 6. The lantern deck and catwalk appear to have been painted in a dark color by the time figure 6 was taken.

The lighthouse apparently needed reinforcement in 1868, since "tie rods [were] fitted around [the] parapet wall outside, the lower end of each having a cross head bolted to the gallery stone with wedge bolts, and the upper end going through the projecting iron deck of [the] lantern with a nut turned on." (These tie rods are still in place, and their installation date is helpful in dating photographs.) Lantern glass was set; the tower stairways and decks were painted; the illuminating apparatus was examined and the lamps, etc., were repaired; ropes were supplied for whitewashing tackle; and wick rings, stove fixtures, and oil butts were repaired.[54]

In 1869 the illuminating apparatus was overhauled, "the timepiece cleaned and repaired; a door lock for the Assistants' Dwelling and a chest of tools supplied."[55] Further additions to the site took place in 1873 when the fog signal and engine house were constructed east of the main structures, nearer to the edge of the bluff. A fuel shed was also erected at that time.[56]

No documentation of other site developments was found for the period between 1857 and 1868. In the latter year, a plank sink drain was laid and a cesspool was dug, and 300 feet of enclosure fence was rebuilt.

Unspecified repairs were made to the buildings by 1873.[57] By 1880, conditions had gotten so bad that a recommendation was made to rebuild the keepers' dwellings.[58] Apparently the Lighthouse Board took notice: documentation from 1881 stated that the dwelling (singular) had been refloored, shingled, and clapboarded; new doors were fitted; and old doors and windows were repaired. Subsequently, it was reported that "The station is now in excellent condition."[59] The replacement of the original vertical board-and-batten siding on both dwellings with clapboards is confirmed by a historic photograph dated September 13, 1886 (fig. 8).

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[54] See footnote 53.

[55] Annual Report, 1869; Clipping File; RG 26; NA/DC.

[56] Annual Report, 1873; Clipping File; RG 26; NA/DC.

[57] Annual Report, 1873; Clipping File; RG 26; NA/DC.

[58] Annual Report, 1880; Clipping File; RG 26; NA/DC.

[59] Annual Report, 1881; Clipping File; RG 26; NA/DC.

However, additional work was necessary the very next year. The 1882 report stated that "The plastering in the principal keeper's dwelling was repaired and 235 feet of drain-pipe were laid."[60] Perhaps the interior plaster was not replaced in 1881, and therefore was in need of work in 1882. (The extensive work in 1881 also may have damaged the plaster.) Alternatively, the interior plaster may have been replaced in 1881, but in so poor a manner that it had to be redone. The report's reference to drainpipe may suggest that the plank sink drain laid in 1868 was replaced.

Two notations from the early 1880's refer to the light itself. The first mentions the "discontinuance of the light,"[61] and the second mentions an introduction to illuminating apparatus measurements, etc.[62] Neither provides any other specific information.

The historic photographs that have been dated between 1881 and 1898 (figs. 10-14) do not provide much information about the light, because most of them show the curtains inside the lantern in a closed position. These curtains were necessary to protect the Fresnel lens during the day, because sunlight focused back through the glass prisms of the lens would cause enormous heat in the center of the lens, as well as the discoloration of the prisms themselves. Figure 10, dated September 13, 1886, is the only one in which the curtains are open. It reveals a Fresnel lens that appears to be of the first order, the same as installed in 1857.

A survey of the property was conducted on December 18 and 19, 1885, and printed on March 27, 1886. It consisted of two drawings, both signed by E. P. Adams, Light-House Surveyor, and W. S. Stanton, Major of Engineers, Engineer of 1st and 2nd Light-House Districts. Stanton forwarded a tracing of the survey on April 1, 1886.[63]

One of the drawings (fig. 8) details the immediate area around the main buildings; it also shows the more distant fog-signal building and coal house (engine house) in an inset block. A note in the inset directs that "for position [of the buildings] in relation to [the] 'light' see reservation plan." This note refers to the other drawing of the survey (fig. 9), which is a plot plan. This drawing was found in two separate archives. While the clearer of the two images is included in the body of this report, some of its notations have disintegrated; the second copy is included in Appendix K.

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[60] Annual Report, 1882; Clipping File; RG 26; NA/DC.

[61] October 13, 1882; letter book no. 634, p. 624; RG 26; NA/DC. [From the Finding Box.] It is not known what was meant by "discontinuance of the light," but there is no indication that the light was ever extinguished.

[62] July 17, 1883; letter book no. 586, p. 30; RG 26; NA/DC. [From the Finding Box.]

[63] Engineer Stanton, April 1, 1886; letter book no. 645, p. 460; Letters Received; RG 26; NA/DC. [From the Finding Box.]

The survey provides a wealth of information about many aspects of the lighthouse tract. Perhaps most importantly, it indicates that the following buildings were extant at that time:

Light Tower
Principal Keeper's Dwelling
First & Second Assts.'s Dwelling
2 passageways
Principal Keeper's Wood House
First Asst.'s Wood House
Second Asst.'s Wood House
Fog Signal House
Coal House-formerly called the engine house
Barn & Hen Houses
Merchant Marine Telegraph

These same buildings probably existed in 1873, based on the lack of written documentation for construction work between 1873 and 1885. A possible exception is the barn. The 1885 survey shows it in the southwest corner of the property. This differs from the location of the barn in previous illustrations—immediately south of the lighthouse. A 20th-century annual Coast Guard report (n.d.) states that a new barn was built on the site in 1888. Taken together, this information suggests that the old barn was removed, and a new barn was built in a new location, shortly before 1885. (The 20th-century report seems to have erred slightly in terms of date.)

In addition, the survey provides information about the appearance of the structures on the site. The first (or detail) drawing of the survey notes that the lighthouse was constructed of brick, as were the adjoining passageways, while all of the other structures were of wood construction. The drawing also provides measurements for all the structures and the locations of exterior steps, which presumably led to exterior doorways.

The survey also offers information about structures other than those directly related to the lighthouse. For example, it indirectly indicates the existence of the Highland Lifesaving Station, seven-eighths of a mile west of the light. The detail drawing shows a cross drawn in the picket-fence line directly in front (to the west) of the principal keeper's dwelling, with the notation "gate" next to it. This is quite likely the turnstile that Stanton reported on May 15 had been installed in the fence for the convenience of the lifesaving patrol.[64]

The plot plan also shows the privately operated Merchant Marine Telegraph building outside the northwest corner of the property, distinguished by the letter "J". This was the Cliff House, built in 1880 as the home of Isaac M. Small, the longtime "Marine Observer" and operator of the telegraph station. An 1891 pamphlet states the following about the structure: "The building just north of the lighthouse is the home of the Marine Observer, connected by Electric Telegraph directly

[64] Engineer Stanton, May 15, 1886; letter book no. 645, p. 708; Letter Received; RG 26; NA/DC. [From the Finding Box.]

with Boston and by Government Telephone with all the Life Saving Stations on the coast."[65] As stated previously, the telegraph office was probably located in the third keeper's dwelling when the latter was built in 1857. It is not known if the office remained there until the Cliff House was built in 1880, nor exactly when prior to 1885 it was moved to the Cliff House.

The main reason for conducting the 1885 survey, however, appears to have been related to anticipated changes to the site's property fencing. This idea is based on the large number of references in the documentation from 1886 to such changes. Prior to that year, the main group of buildings was surrounded by a wooden picket fence, as shown in the survey's detail drawing (fig. 8). A board-rail fence extended at least to the south of the property (fig. 10). Engineer Stanton wrote on April 15 that he was rebuilding fences and buying the fence material through an open purchase.[66] On May 11, R.J. Davis wrote that he was placing a barbed-wire fence, under protest of their neighbor "J. Small." The latter was undoubtedly abutter Isaac M. Small, whose first initial "I" was often written looking much like a "J."[67] (Small apparently wrote his own letter of protest in June, requesting to meet with the engineer secretary.[68])

The date of installation for the barbed-wire fence and its wood posts is unclear. Figure 10, taken on September 13, 1886, shows the earlier board fence. However, it existed by the end of that year, since a notation from the 1886 Annual Report states that "the light-house reservation was inclosed by a barbed-wire fence."[69] Apparently the barbed-wire fencing was used to replace the earlier board-rail fence, but was also extended to enclose the entire property. A photograph dated 1886-1898 (fig. 11) shows that the picket fence remained standing after the barbed-wire fencing had been installed. Other activity at the site in 1886 included the addition of three new smokestacks to the fog-signal building. These had been built by the time figure 10 was taken on September 13, 1886. Another notation in the 1886 Annual Report said: "three new smoke stacks were supplied."[70]

Figure 11 is the earliest of a group of photographs taken of the site after September 1886, but before April 1898. It shows that the trim of the dwellings was painted a contrasting color to the bodies by this time (probably the light gray found in the paint sample from the basement-window frame). The remainder of the group—figures 12 to 14—were all taken the same day, based on

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[65] Small, p. 15.

[66] Engineer Stanton, April 15, 1886; letter book no. 645, p. 534; Letters Received; RG 26; NA/DC. [From the Finding Box.]

[67] R. J. Davis, May 11, 1886; letter book no. 674, p. 350; Letters Received; RG 26; NA/DC. [From the Finding Box.]

[68] I. Small, June 28, 1886; letter book no. 674, p. 700; Letters Received; RG 26; NA/DC. [From the Finding Box.]

[69] Annual Report, 1886; Clipping File; RG 26; NA/DC.

[70] Annual Report, 1886; Clipping File; RG 26; NA/DC.

identical attributes such as the height of various window shades, the positions of exterior doors, and staining. These photographs indicate that the picket fence was removed from the west property boundary before 1898. The trim of all structures was at that time still painted in a contrasting color.

Inspector Wilde reported on March 4, 1891, that the keeper's dwelling had been struck by lightning.[71] Two subsequent entries within the following week recorded that damage had occurred and that a requisition for $140.00 was needed for repairs.[72] The lightning strike occurred on February 28, requiring extensive and immediate repairs to the "clapboarding, masonry, plastering, interior joiner work, shingling, and lead flashing."[73] The description of the damage suggests that the building suffered severely, possibly from fire.

Authority for placing a Kane signal staff on the site was requested at the end of April 1898.[74] Six weeks later a description and photograph pertaining to the site were transmitted, but the nature of each was not specific.[75] It is believed that the Kane signal staff was a black vertical bar attached to the tower lantern. Based on this assumption, one photograph (fig. 15) and one postcard (fig. 16) date to this time: the photograph could be the one that was transmitted in 1898. Both images show that the trim of the structures had been painted in a darker contrasting color by this time, probably a dark gray found in paint samples.

No changes or additions to the site or ancillary structures were made between 1891 and 1898, according to the documentation.

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[71] Inspector Wilde, March 4, 1891; letter book no. 878, p. 760; Letters Received; RG 26; NA/DC. [From the Finding Box.]

[72] Engineer Stanton, March 7, 1891; letter book no. 879, p. 412; and March 11, 1891; book 879, p. 422; Letters Received; RG 26; NA/DC. [From the Finding Box.]

[73] Annual Report, 1891; Clipping File; RG 26; NA/DC.

[74] April 30, 1898; letter book no. 1214, p. 1052; Letters Received; RG 26; NA/DC. [From the Finding Box.]

[75] June 9, 1898; letter book no. 1215, p. 564; Letters Received; RG 26; NA/DC. [From the Finding Box.]



Figure 4. Cape Cod Light, looking northeast, between 1857 and 1868.



Figure 5. Cape Cod Light, looking north-northwest, between 1857 and 1868.

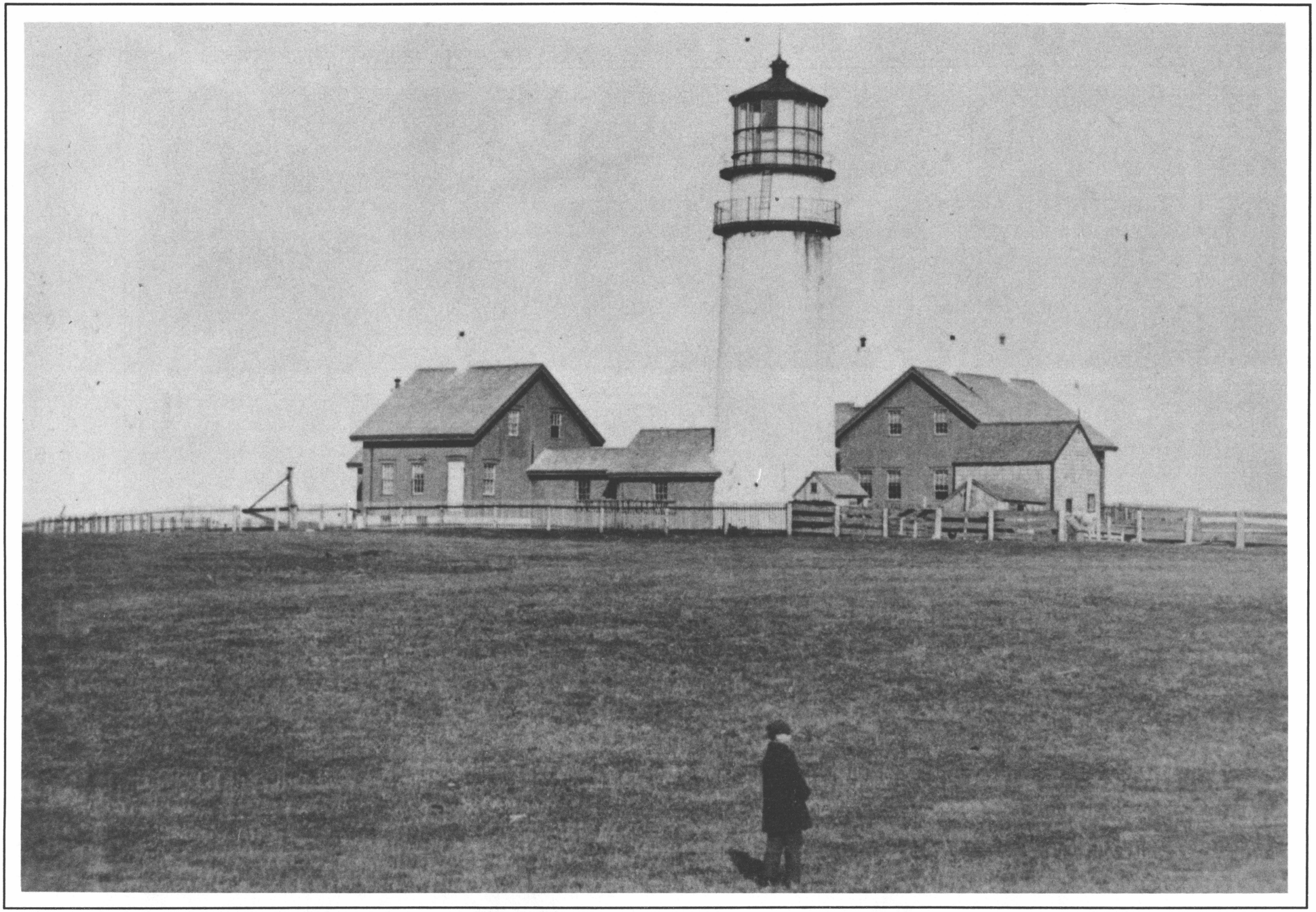


Figure 6. Cape Cod Light, looking northeast, between 1868 and 1881.

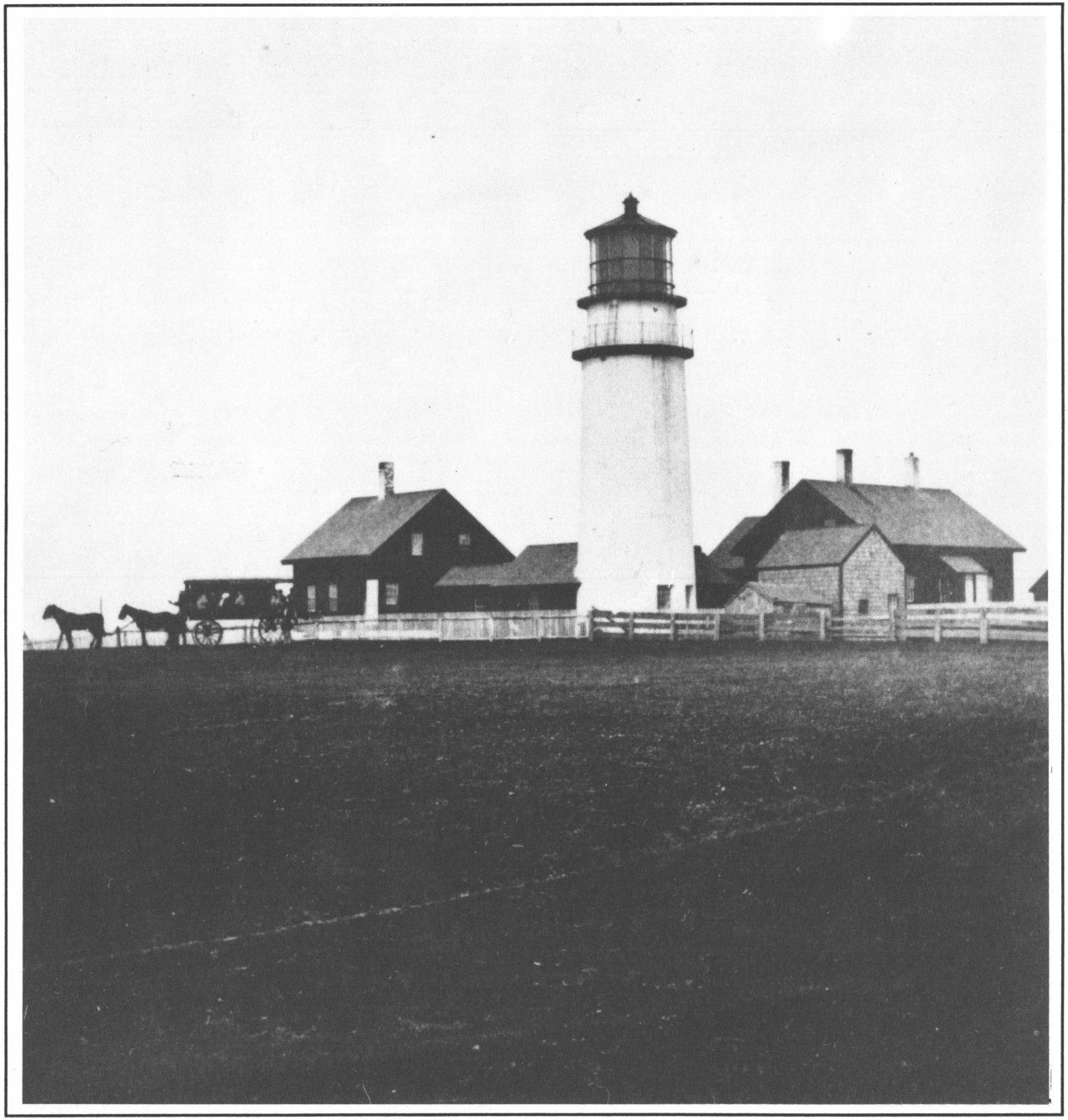


Figure 7. Cape Cod Light, looking northeast, between 1868 and 1881.

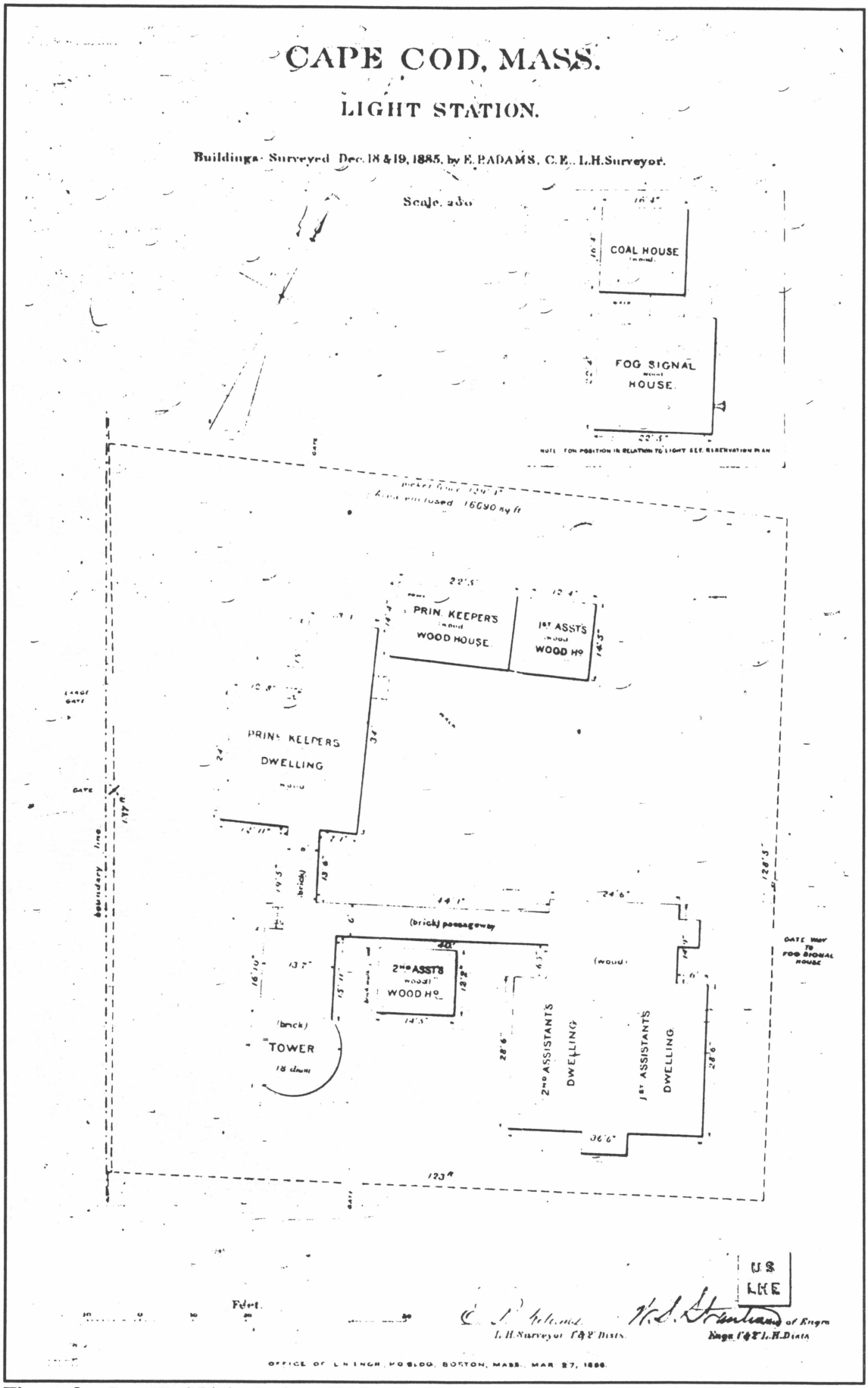


Figure 8. Cape Cod Light Station, 1885 survey.

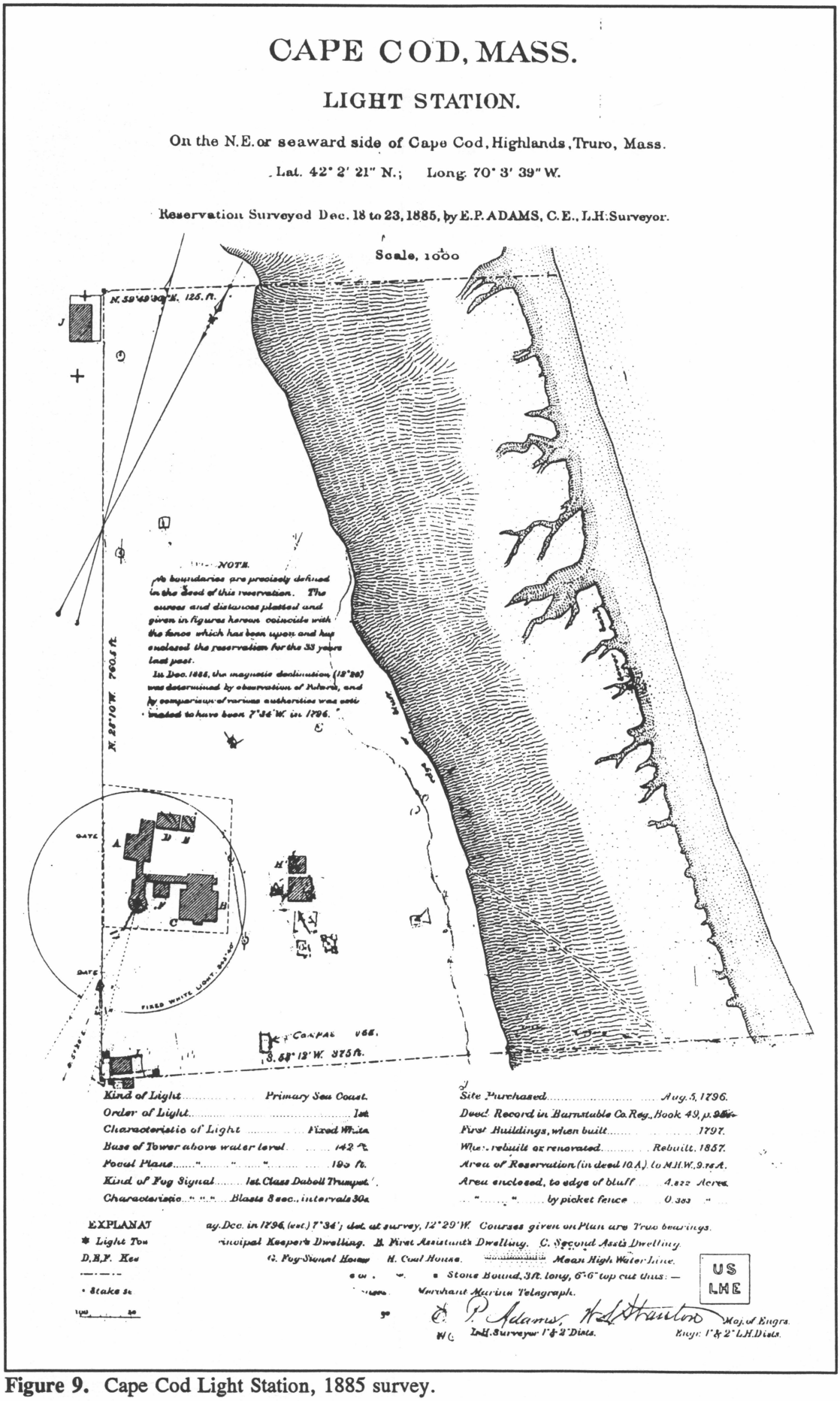


Figure 9. Cape Cod Light Station, 1885 survey.



Figure 10. Cape Cod Light, looking northeast, September 13, 1886.



Figure 11. Cape Cod Light, looking northeast, between 1886 and 1898.

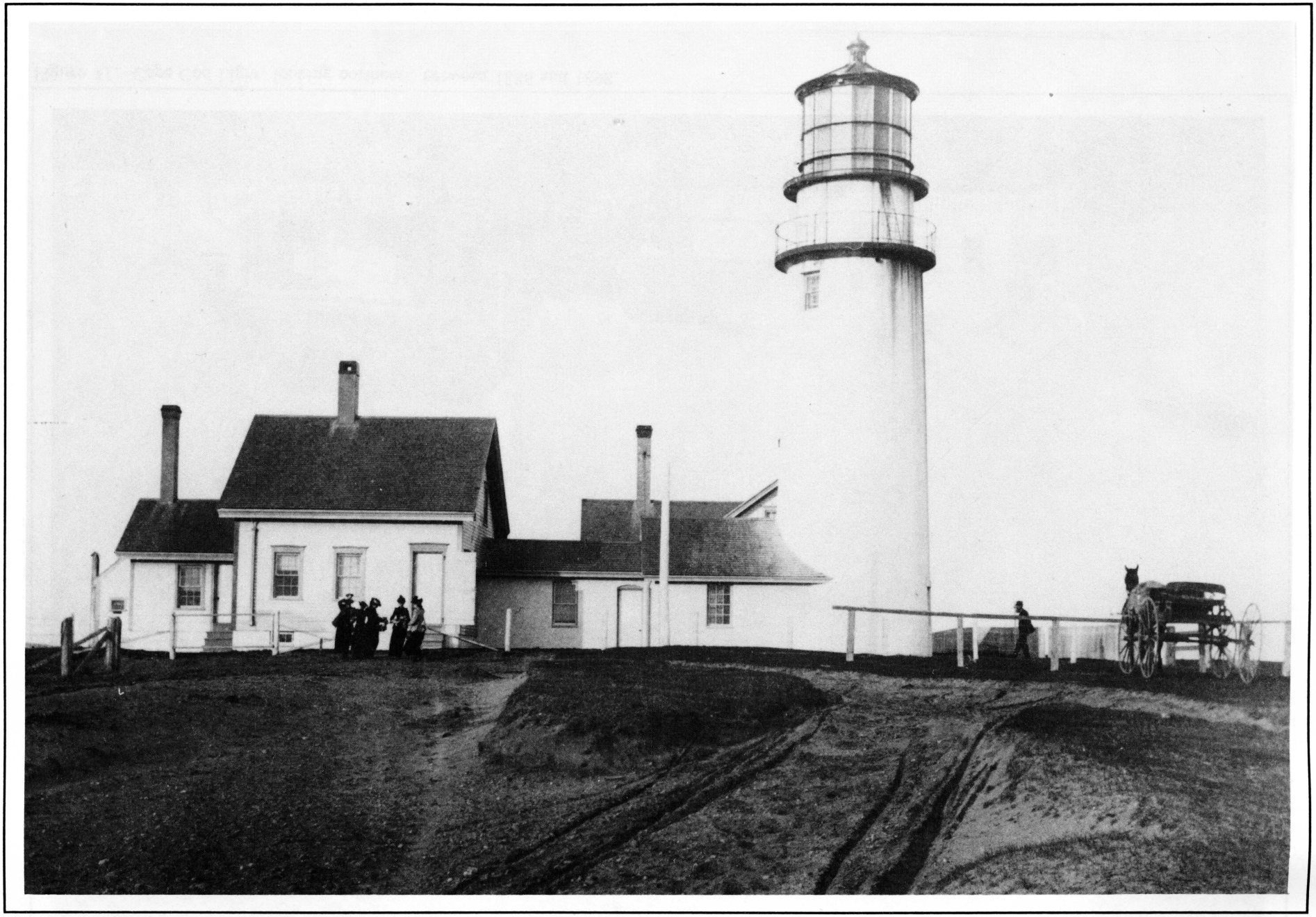


Figure 12. Cape Cod Light, looking northeast, between 1886 and 1898.



Figure 13. Cape Cod Light, looking east, between 1886 and 1898.

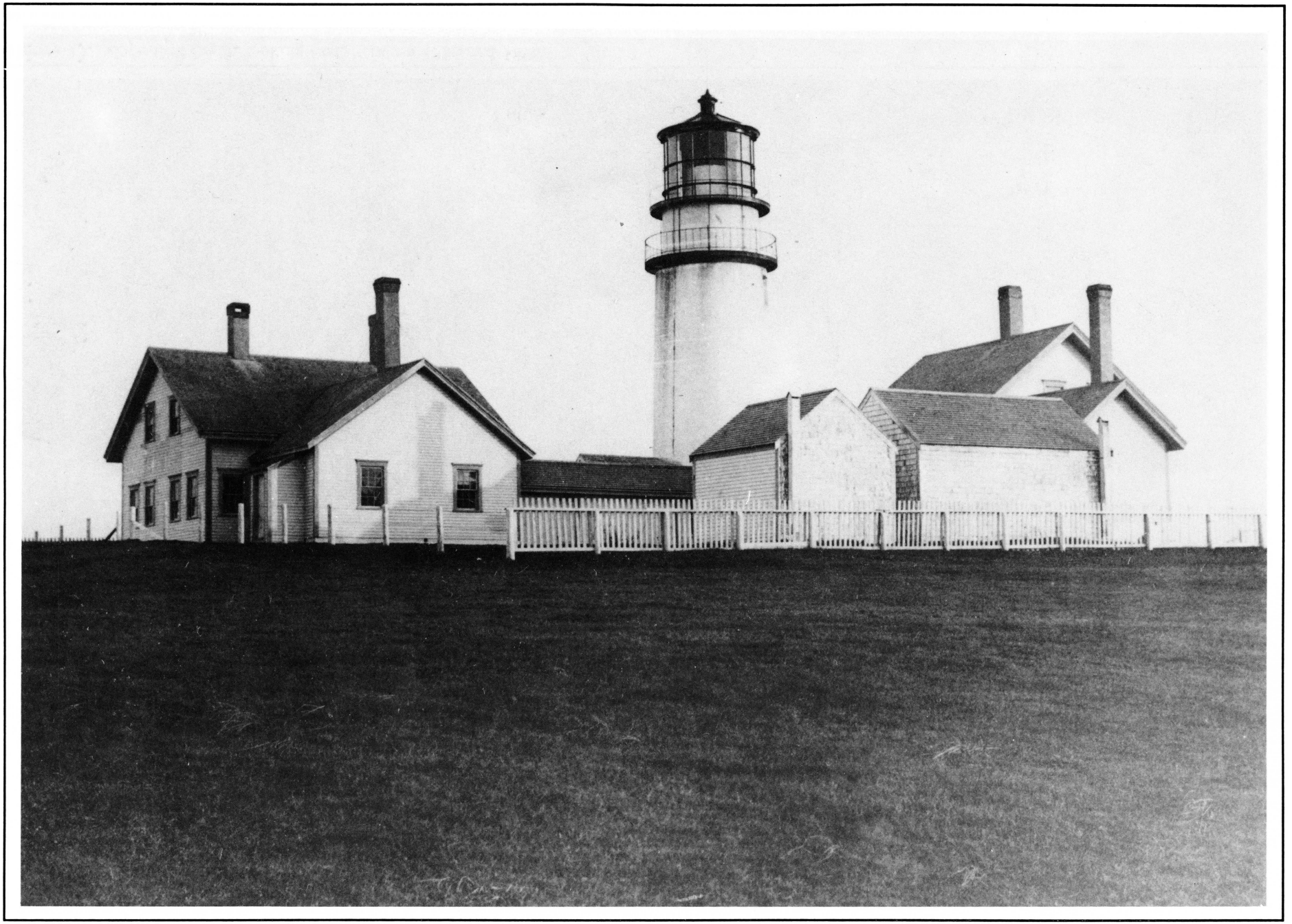


Figure 14. Cape Cod Light, looking east, between 1886 and 1898.



Figure 15. Cape Cod Light, looking east, circa 1898.



Figure 16. Cape Cod Light, looking northeast, circa 1898.

1898 to 1947

The Bureau of Lighthouses and the U.S. Coast Guard

The Lighthouse Board, which had been established in 1852, continued to administer aids to navigation until 1910. (However, in 1903 it was transferred from the Treasury Department to the Department of Commerce—then the Department of Commerce and Labor.)[76] During the board's existence, the number of aids to navigation in the United States increased dramatically. In 1852 there were more than 1,500 aids, of which 331 were lighthouses; by 1913, there were 12,824 aids, of which 1,462 were lighthouses.[77]

However, complaints against the Lighthouse Board had begun to arise. A consensus emerged that the nine-member board was too cumbersome and should be replaced by a single executive. There was also a feeling that an essentially civilian function should not continue to be dominated by the military. Congress responded by abolishing the board in 1910 and transferring its responsibilities to a new Bureau of Lighthouses.[78]

The period of the bureau's existence was one of continued expansion. During most of the time, it was headed by George R. Putnam. Putnam's administration of the bureau lasted until 1935—a tenure comparable with Pleasonton's, but generally conceded to be far more effective. During this period, aids to navigation increased not only in absolute numbers, but also in their complexity and capabilities. This era of rapid change brought technological improvements such as greater use of electricity, greater automation, and the introduction of radio beacons.[79]

A major reorganization of the federal government in 1939 abolished the lighthouse bureau and transferred aids to navigation to the Coast Guard. This placed lighthouses back under the administration of the Treasury Department, where they had resided from 1789 to 1903. Like its predecessor agencies, the Coast Guard divided the country administratively into a number of districts.

Activities at the Highland Light

Major changes were made to virtually all aspects of the Highland Light around the turn of the century. They included the installation of a new illuminating apparatus, improvements to the dwellings, and the addition of support structures.

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[76] George R. Putnam, *Lighthouses and Lightships of the United States* (Boston: Houghton Mifflin, 1917), p. 46.

[77] Holland, *America's Lighthouses*, p. 37; also Holland, draft National Historic Landmark thematic nomination (National Park Service, 1993), p. 30.

[78] Holland, *America's Lighthouses*, p. 37.

[79] Holland, *America's Lighthouses*, p. 38.

Alterations to the Dwellings Circa 1900. The year 1898 marked the beginning of major changes to the site's dwellings. Beginning with a letter dated October 1, the major of engineers for the second lighthouse district gave a description of the keeper's dwelling and reasons for a need to alter it:

> At cape cod, mass light station which I inspected August 28 the keepers dwelling has only two sleeping rooms, each lighted by only one window facing north. The kitchen has not enough closet room and is in the ell, which has only one story. The ell is 13ft x 15ft 6 inches should be extended three feet to give more closet room, a second story should be built upon it to provide another sleeping room, and four dormer windows should be built to give the present sleeping rooms more light, and to give them sun. For this purpose there is an item of $800 in the supplemental estimates of funds required from the appropriation for 'Repairs and Incidental Expenses of LightHouses 1899,' in the second district, submitted this date.
>
> If funds permit, authority is desired to make the repairs,-- hire of labor, and purchase of materials in open market,--10 days advertizement, of the lowest bidder without formal contract, because this method is the most economical and advantageous to the government.[80]

The Annual Estimates showed an entry of $800.00 for Cape Cod light. Labor was estimated at $410.00 and materials were estimated at $390.00 for the "addition to keepers dwelling with kitchen below and bedroom above and four dormer windows."[81]

While no further correspondence relative to these changes was located, two sets of the same drawings were found, one (app. L) in the Coast Guard's Civil Engineering Unit Providence (CEU), and one (app. M) in the Coast Guard Academy Library microfilm collection, dating to April 1899 and signed by Major Engineer Stanton. These drawings represent the majority of changes proposed in the 1898 letter transcribed above. The set retrieved from the Academy Library does not reflect any sheet numbering, approval notations, or later alterations. This set additionally contains the plan of the existing (pre-1899) second story, which the CEU's set does not contain, but is missing the proposed front (west) elevation drawing, which the CEU's set does contain. On the CEU's set, sheet one denotes that the plans were approved by a Light House Board telegram of April 25, 1899. The proposed plans from the same set reflect alterations that were added at some later date, including the locations of electric ceiling fixtures, the additions of radiators, a notation that "A No. 0019 Magee Heater was used here," the addition of a piazza, and a sink alteration.

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[80] Major of Engineers, U.S. Army, Engineer second lighthouse district, October 1, 1898; letter book no. 1248, pp. 282-284; Letters Received; RG 26; NA/DC.

[81] Annual Estimates, July-December 1898; letter book no. 1248, p. 318; Letters Received; RG 26; NA/DC.

The simple line drawings that represent existing (pre-1899) conditions reflect a much different floor plan than the present one. But the locations of the exterior stoops are in the same locations as those on the 1885 survey map (fig. 9), suggesting that little changed in the 14 years preceding 1899. These earlier plans may also reflect the same general conditions of original construction. The only known major alteration prior to this time was the replacement of the exterior siding.

Originally, the main entrance on the west elevation of the main block was at the south end, with two additional window bays to the north. The north ell also had an entrance at the south end of the west elevation, with one window opening to the north of it. The ell had a second entrance on the east elevation, again at the south end with a window to the north of it. The east elevation was contiguous with that of the main block, which had three window bays. Six additional window openings were located in the main block. One each was on the north and south elevations at the first-story level, and two were on the north elevation and two on the south elevation at the second-story level.

In plan, the main entrance opened into a hallway, with the second-story staircase directly in front of the door. The main block consisted of a two-room plan, with two staircases in the hall along the south wall. A doorway at the center of the south wall led to the connecting passageway to the lighthouse, while the stairway to the cellar was in the east half of the house along the south wall, *not* under the stairway to the second floor. The dining room was situated in the back or east half of the main block and connected to the kitchen ell to the north. No fireplaces were evident in these simple drawings, but a chimney stack separated the parlor or west room from the dining room, and another stack was located at the center of the north wall of the kitchen ell. As described by the major of the engineers, the second story of the dwelling occupied only the main block, containing two chambers separated by the chimney stack, each with one window on the north elevation. The stair hall, containing two window openings on the south wall, extended almost the full length of the same wall, with a closet in the southwest corner.

The Barnstable *Patriot* recorded on May 1, 1899, that "Lumber and workmen have arrived at the Light house to commence the contemplated improvements and changes."[82] These alterations radically changed the interior floor plans. The main doorway was switched with the window at the north end of the main block's west elevation. A vestibule and closet were created at this entrance, and both stairways were relocated behind the vestibule, one under the other. The configuration of the stairway to the second story was changed from a straight run to U-shaped, with six winders (and no landings) negotiating the change of direction. This alteration necessitated the removal of the window opening at the first-story level of the main block's north elevation. The larger chimney stack remained near the center of the main block, but the removal of the hall and staircases at the south end created enough space to shift the parlor and dining room to the south. The window that had been near the west corner of the south wall of the entrance and stair hall was moved slightly to the east to be centered on the new parlor's south wall. A closet was created along the south wall of the dining room without blocking the doorway to the connector link. However, the creation of the closet required that the southernmost window on the east elevation be moved slightly to the north.

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[82] Barnstable (MA) *Patriot*, May 1, 1899.

Instead of increasing the kitchen ell by 3 feet, as recommended, the wall that had separated the dining room from the kitchen was moved to the south approximately 3 feet, keeping the same north-south division, but in a slightly different location. Both exterior doorways were removed from the kitchen ell and replaced with window openings, but the east opening was moved slightly to the south. The closets that had been at the north end of the room were simply enlarged: the one in the northwest corner now contained a pantry with a sink, and a new window over the sink on the north wall. The pantry encased the smaller chimney stack, with a stovepipe feeding into the kitchen space. The new space in the northeast corner became an entry vestibule, with a "back door" proposed on the east wall. This configuration was changed when the porch was added, perhaps at the time of actual construction, or shortly thereafter. The doorway then led into a small vestibule or mud room from the kitchen's north wall.

At the second-story level, the ell (and its chimney) was heightened to include a second story as recommended. All existing interior partitions in the main block were removed except those covering the main chimney stack. Since the original hall and staircase were removed, the two chambers were shifted to the south with a closet wall (the depth of the chimney stack) dividing them. A second closet was constructed for the southwest chamber, above the first-story entry vestibule. A closet wall also separated the southeast chamber from the newly built ell chamber. This latter chamber occupied some of the main block's space. One dormer window was installed in each of the chambers, with the southwest and ell chambers' dormers facing west, and the southeast chamber's dormer facing east. It seems that only three dormers were added at this time, instead of the four that were proposed. A small window opening was also installed on the north wall of the ell chamber, immediately to the east of the chimney stack.

In all, one exterior doorway was removed, and two were relocated and possibly reused. Two additional windows were required for the first story. The other relocated windows were probably reused. One window was removed from the second story; a new, possibly smaller one was installed; and three new dormer windows were installed. The one window removed from the second story may have been reused on the first story.

A bulkhead entrance to the cellar was added during these renovations. No documentation suggested that the clapboarding or roof covering was changed, but perhaps the clapboarding required patching. The Annual Report from 1901 records that "The work of repairing, rearranging, and improving the first and second assistants' dwellings, commenced in June, was almost completed at the close of the fiscal year."[83] One could logically assume that this entry referred to the previous calendar year, 1900.

On May 22, 1900, while planning was underway to replace the light apparatus, the engineer requested authority to make needed improvements to the dwellings.[84] The documentary evidence concerning this work is confusing. The Barnstable newspaper recorded that the work was begun in

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[83] Annual Report, 1901; entry #135; Clipping File; RG 26; NA/DC.

[84] Engineer, 2nd District, May 22, 1900; letter book 1320, p. 414; Letters Received; RG 26; NA/DC. [From the Finding Box.]

May 1899, but the annual report for 1901 suggests that the work on the dwellings took place throughout the summer of 1900. The only mention of any dwelling-related activity in the 1900 Annual Report was the laying of a concrete floor in the covered ways connecting the lighthouse tower and the dwellings.[85]

The annual report for 1902 states: "The improvement and repair of the double dwelling occupied by the assistant keepers were completed and a veranda was built on the keeper's dwelling."[86] The veranda or porch may have been an afterthought to the submitted 1899 plans, because no details surfaced that hint of its impending construction. However, the word "piazza" is added in handwriting to the first-floor drawing of the keeper's dwelling in one set of the alteration drawings (app. L). Clearly the evidence shows that the porch had been completed by 1902, and more likely by 1901.

The earliest depiction of the site after this work is a postcard dated 1905 (fig. 19). It reflects the several exterior changes to the keeper's dwelling. These include the relocation of the main entrance (with its stair protecting the basement window from which the earliest exterior paint sample was removed), the enlargement of the ell, the addition of the porch around the ell, and the addition of the second-story dormers. The trim was again painted in a contrasting color; the pedimented lintels remained on the keeper's dwelling.

Alterations to the Light Circa 1900. On February 5, 1900, an estimate was requested or submitted for changing of the characteristic of the Highland Light from a fixed to a flashing light.[87] Congress appropriated $15,000 for that purpose on June 6.[88] Apparently a number of options were evaluated: two similar charts dated July and August (figs. 17 and 18, respectively) list and compare the attributes of 12 different apparatus systems. Figure 17 appears to represent the first attempt at entering the data into the chart, since it has corrections made in pencil; figure 18 appears to be the corrected chart. A handwritten note on the margin of the second chart notes that the fifth entry was the one that was selected: design number 14627, manufactured by Barbier & Benard, Paris. The system included a first-order lens, with four 90° panels, nine dioptrics, 18 superior and eight inferior catadioptrics, and a focal distance of 92 mm or 36.22 inches. The burner was available in either a five- or six-wick model. The diameter of the five-wick burner was 110 mm or 4.33 inches; the intensity of its beam would have been 192,080 c.p. (candlepower), with a .38-second duration of flash. The diameter of the six-wick burner was 130 mm or 5.118 inches; the intensity of its beam would have been 204,660 c.p., with a .45-second duration of flash. In either case, the time of one revolution was 20 seconds, and the F.O.B. cost in an English or French port was $9500, with the equipment to be delivered four months after the receipt of order.

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[85] Annual Report, 1900; Clipping File; RG 26; NA/DC.

[86] See footnote 85.

[87] February 5, 1900; letter book no. 1320, p. 98; RG 26; NA/DC. [From the Finding Box.]

[88] Appropriation by act of Congress, June 6, 1900; Clipping File; RG 26; NA/DC.

Specifications were submitted on September 29 as follows:

In compliance with boards [sic] letter of 18 July 1900. . . . The estimated cost is:

One first order apparatus in foreign port	$ 9,500.00
Freight to the United States. About 150 cu ft.	250.00
Freight wharfage and carting in the United States	300.00
One set first order lamps	500.00
Modifications of tower for new apparatus	500.00
Dismantling, boxing, freight and carting on present lens	250.00
Temporary tower, lantern and glass	400.00
Rigging and tools	400.00
Taking down, packing and freight on temporary tower and lantern	100.00
Superintendence	300.00
Traveling Expense	100.00
Contingencies	2,000.00
Total $14,750.00[89]	

Note that the cost of the apparatus listed with the specifications is the same as the cost of the selected item in the chart.

Again, two annotated versions of the same drawing exist, culled from two different Coast Guard sources. The drawing is entitled, "Lantern & Watchroom" at the "Cape Cod Lt. Station" (app. N). One version is labeled Sheet 1, "2[d] Dist. 3 C. with Engr's lett. #81. of 29 Sept. 1900, filed 1 Dec.-"-[1900]. The other version is labeled Plate 1, "Accompanying Specifications for Illuminating Apparatus." The drawing obviously was meant to accompany the letter above and appears to represent the entry: "Modifications of tower for new apparatus." However, modifications other than the purchase of new equipment were not specified either in the letter or the drawing.

The Annual Report from 1901 notes that the optical apparatus was ordered from Europe on March 13, 1901. "It has four panels of 0.92 meter focal distance, revolves on a float in mercury, and will give every 5 seconds, flashes of about 192,000 candlepower nearly one-half second in duration. It will soon be received and installed. Materials for building a temporary tower for use during the installation of the new optical apparatus were sent to the station."[90] The Barnstable paper recorded on September 16, 1901, that "The oil steamer Azalia [operated by the Light House Board] landed the lighthouse apparatus at Provincetown and it was carried over from there. The steamer has returned to New York for the machinery to go in the permanent tower."[91] Meanwhile,

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[89] September 29, 1900; letter book no. 1373, p. 270; Letters Received, 1st & 2nd Engineering Districts, July to December 1900; RG 26; NA/DC.

[90] Annual Report, 1901; entry #135; Clipping File; RG 26; NA/DC.

[91] Barnstable (MA) *Patriot*, September 16, 1901.

details for the apparatus's new smoke pipe and its support were being designed by the U.S. Lighthouse Machine Shop in Boston, MA (app. O), as was a ball bearing, probably to be used in the float mechanism.[92]

The Annual Report for 1902 confirms the following: "The new apparatus was installed in September and October, and the light (now flashing white instead of fixed) was first exhibited on October 10, 1901. . . During the installation, a third-order light flashing white every 5 seconds was exhibited from a temporary skeleton tower. The tower was sold at auction when it was no longer needed. The old fourth-order fixed lens and the temporary third-order lens were returned to the general light-house depot."[93]

This information suggests that a fourth-order lens had been installed in the lighthouse. Previous documentation indicates that a first-order lens had been installed in 1857. If, when, and why this replacement occurred is unknown. The documentation merely records that the extant light would be changed from a fixed to a flashing light, not that it was defective and needed temporary (fourth-order lens) and then permanent replacement.

The earliest depiction of the site after this work is a postcard dated 1905 (fig. 19). This illustration is the first to depict the edge of the tower's granite gallery as painted white. It probably was whitewashed when the tower was similarly finished.

An April 4, 1903, drawing from the Coast Guard files is entitled "Handrail for Cape Cod Light Tower" (fig. 20). Not only does this drawing depict a full-size section of a handrail, but also a plan for a run of stairs including 43 risers. An accompanying note relates that "There will be three runs of stairs with two landings and a half deck at the top. Rise of stairs 8" - tread 8"." The forty-third riser landed at the half deck. According to the plan, these stairs ascended to a deck that is currently two below the watch deck and three below the lantern deck. This is illustrated more clearly in a 1907 drawing showing the illuminating apparatus (fig. 21). The actual changes become more clear when this information is compared to the drawing of the assumed generic or initial proposal for the light tower construction (see fig. 1), where the staircase winds around a center pole to the first (or weight) deck below the watch deck. The center winding stair was replaced by a new stairway with two small landings that hugged the wall. A new deck, occupying only half the available floor space, was installed below the original lowest deck (weight deck). The 1907 drawing documents a ladder-type stair negotiating the connection between the new half deck and the one above it. This latter, original weight deck remained in place, along with its more ornate metal staircase that accessed the watch deck. The extant lower staircase and deck configuration was that installed in 1903. The extant noncontiguous metal stair that connects the first half deck to the weight deck was probably added at a later date. The same may be true for the metal stair that interconnects

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[92] Drawings entitled "Ball Bearing - Cape Cod," August 16, 1901; files; U.S. Coast Guard Civil Engineering Unit Providence (USCG CEU Providence); Warwick, RI.

[93] Annual Report, 1902; entry #136; Clipping File; RG 26; NA/DC.

the watch and lantern decks, since the 1907 drawing depicts only a freestanding, ladder-like apparatus leading into the center of the Fresnel lens.

Further verification of the change in the staircase was found in the Barnstable paper: "Workmen are engaged in removing the winding stairs at the Highland Light and replacing them with stairs attached to the wall of the tower, in a circle with an additional landing platform about eight feet below the present first landing."[94] This quote descriptively confirms the new installation.

A drawing dated 1906 and entitled "Lantern Lining and Cone for Cape Cod Lt. Station" depicts drawings of the lantern lining and cowl (app. Q). Since the *American Heritage Dictionary* defines cowl as "a hood-shaped covering used to increase the draft of a chimney," the cowl (and not cone) most likely would have fitted over the chimney of the Fresnel lens, while the lantern lining would have fitted above it, into the "roof" of the lantern. A later photograph (fig. 32) shows the cowl in place under the lantern hood.

The 1907 drawing previously mentioned, "Showing Illuminating Apparatus," may have been authorized only for documentation purposes (fig. 21); it certainly serves this purpose almost 90 years later. Not only does it delineate the staircase, but also the Fresnel lens and rotating illumination mechanism. Some type of storage unit is drawn in elevation on the ground story of the lighthouse. Whether this was used for oil storage or other supplies is unknown.

[94] Barnstable (MA) *Patriot*, April 27, 1903.

Cape Cod Light Station, Mass.

Optical Apparatus for Flashing Light

Abstract of Replies Received to Letters addressed to Foreign Manufacturers — July and August 1900.

Apparatus				Lens.					With Burner of 5 Wicks.					With Burner of 6 Wicks.					Time of One Revolution. Sec's.	Cost F.O.B. in English or French Port.	Delivery in Mos. after Receipt of Order.	Number of Design.	Maker
				No. of Elements							Beam					Beam							
Number	Order	No of Panels	Degrees Each	Dioptric	Catadioptric Reflecting	Catadioptric Refracting	Dia. of Lens	Focal Dist.	Dia. of Burner	Intensity of Naked Flame	Divergence	Intensity	Duration of Flash	Diameter of Burner	Intensity of Naked Flame	Divergence	Intensity	Duration of Flash					
1	3	2	180°	7	13	13	7'-2"		110 m/m 4.33"				.35 sec	130 m/m 5.118"			113 595	.40 sec	10	$ 4800	3½	25034	Barbier & Bénard, Paris
2	3	2	180°	3	11			500 m/m 19.685"									130 000	.33 sec	10	$ 5000	5		Sautter, Harlé & Co., Paris.
3	3	2	180°											120 m/m 4.25"	48 C.P. (355)	13°-6'	118 900	.38 sec	10	$ 4080	6		Henry Lepaute, Paris.
4	3	2	164°	6	11				4.18"	500		70 000	.34 sec	4.25"	730		100 000	.34 sec		$ 4500	8	1644	Chance Bros & Co. Birmingh
5	1	4	90°	9	18	8		920 m/m 36.22"	110 m/m 4.33"			192 080	.38 sec	130 m/m 5.118"			204 660	.45 sec	20	$ 9500	4	14627	Barbier & Bénard, Paris
6	1	3	120°										.28 sec				272 850	.34 sec	15	$ 9500		15276 15277	do
7	1	6	60°									128 000	.56 sec						30	$ 9500	4		do
8	1	4						920 m/m 36.22"									205 000	.40 sec	20	$ 11300	8		Sautter, Harlé & Co, Paris
9	1	4	90°					920 m/m 36.22"						120 m/m 4.25"	48 C.P. (355)	7°-1'	258 800	.395 sec	20	$ 9240	6	654.7	Henry Lepaute, Paris.
10	1	4	90°	16					4.18"	500		115 000	.375 sec	4.25"	730		180 000	.375 sec		$ 9250	8	1641A	Chance Bros & Co. Birmingh
11	1	4	90°	8					4.18"	500		110 000	.375 sec	4.25"	730		170 000	.375 sec		$ 9000	8	1641B	do
12	HYPER-RADIANT	3	120°	10	25	12		1330 m/m 52.47"						130 m/m 5.118"			604 300	.23 sec	15	$ 20000	7	25032 25033	Barbier & Bénard, Paris.

OFFICE OF LIGHT-HOUSE ENGINEER, 1ST. & 2ND. DISTS.

Transmitted to Light-House Board with letter of this date.

W. H. Sanford LT. COL.

ENGINEER 1ST & 2ND

Figure 17. Abstract of Information for Lens Apparatus, with corrections, 1900.

Abstract of Information from Foreign Manufacturers Regarding Lens Apparatus Suitable for CAPE COD LIGHT STATION. JULY & AUG 1900.

Apparatus				Lens - Number Elements -							Intensity of Beam C.P.		Flash			Cost				
Number	Order	No. of Panels	Degrees each	Dioptric	Catadioptric Superior	Catadioptric Inferior	Dia. Lens.	Focal Dist.	Dia. Burner 6 Wicks.	Dia. Burner 5 Wicks.	Burner of 5 Wicks = 360 C.P.	Burner of 6 Wicks. = 500 C.P.	Duration of Flash flashing every 5 sec. With 5 wicks Seconds.	Duration of Flash flashing every 5 sec. With 6 Wicks Seconds.	Time of 1 Rev. Seconds.	F.O.B in English or French Port.	Delivery in Mos. after receipt of order.	Design Number	Maker
1	3	2	180°	7	13	13	7-2"		.130m 5.118"	.110m 4.33"		113'595	0.35	0.40	10	$ 4'800.	3½	25 034	Barbier & Benard, Paris.
2	3	2	180°	3	11			50m 19.685				130'000		0.33⅓	10	$ 5'000.	5		Sautter, Harlé & Co., Paris.
3	3	2	180°									116'900			10	$ 4'080.	6		Henry Lepaute, Paris
4	3	2	164°	6	11						70'000	150'000				$ 4'500.	9	1644	Chance Bros & Co. Birmingham.
5	1	4	90°	9	18	8		36.22" .92m	130m 5.118"	110m 4.33"	192'080	204'660	0.38	0.45	20	$ 9'500.	4	14 627	Barbier & Benard, Paris.
6	1	3	120°									272'850	0.28	0.34	15	$ 9'500.		15 276 15 277	do
7	1	6	60°								128'000		0.56		30	$ 9'500.	4		do
8	1	4						92m 36.22				205'000		0.40	20	$ 11'300.	8		Sautter, Harlé & Co. Paris.
9	1	4	90°					92m 36.22				258'800			20	$ 9'240.	6	654-7	Henry Lepaute, Paris.
10	1	4	90°	16	12						115'000	350'000	.275"	"Similar"		$ 9'250	12	1641 A 269 & 273	Chance Bros & Co. Birmingham.
11	1	4	90°	8	8						110'000	330'000	.275"	"Similar"		$ 9'000	12	B 1641	do
12	HYPER-RADIANT	3	120	10	25	12		1.33m 52.41"	.130m 5.118"			604 800		0.23	15	$ 20'000	7	25 032 25 033	Barbier & Benard, Paris.

Figure 18. Abstract of Information for Lens Apparatus, corrected, 1900.



Figure 19. Postcard, "Highland Light," copyright 1905 by Rotograph Co.

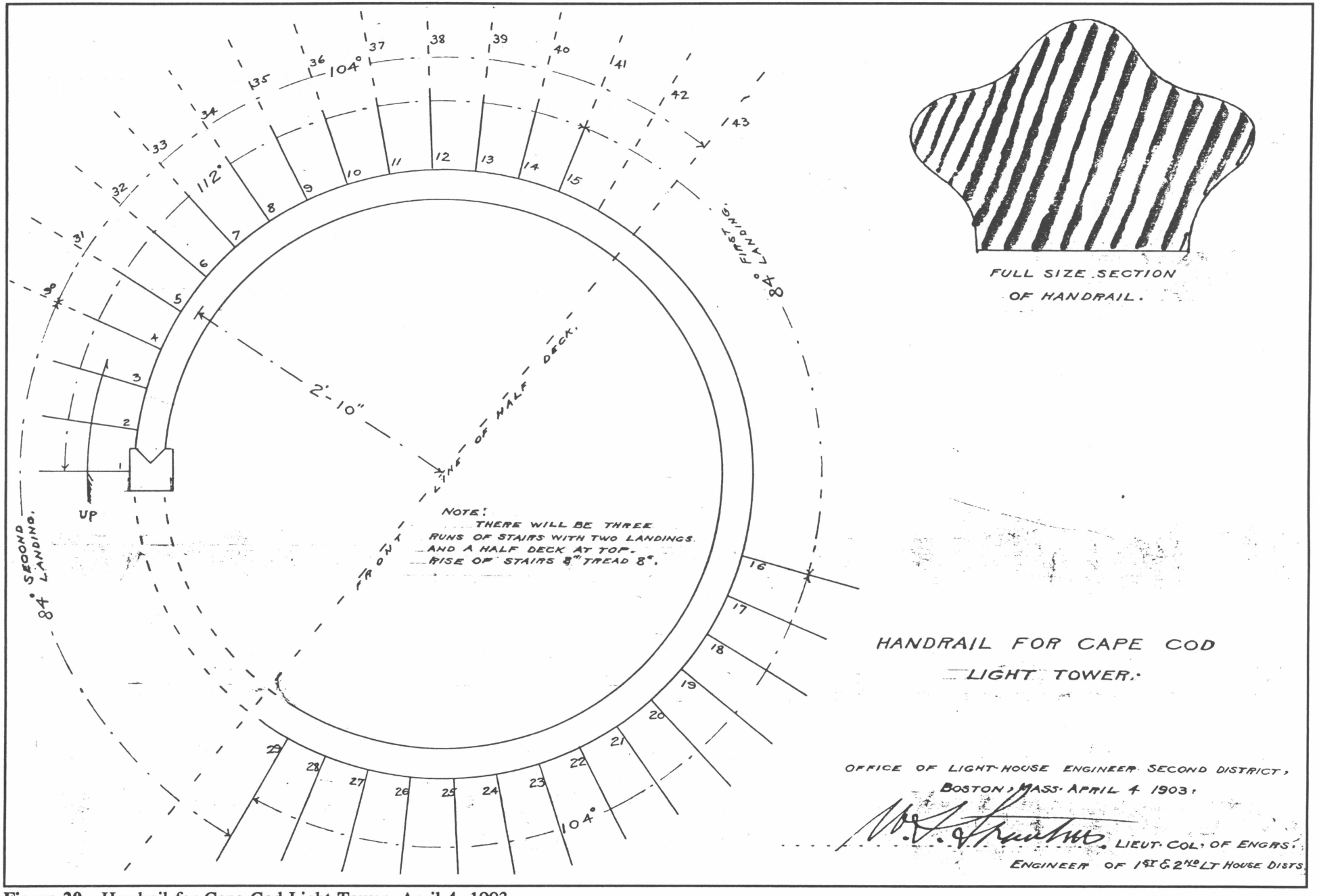


Figure 20. Handrail for Cape Cod Light Tower, April 4, 1903.

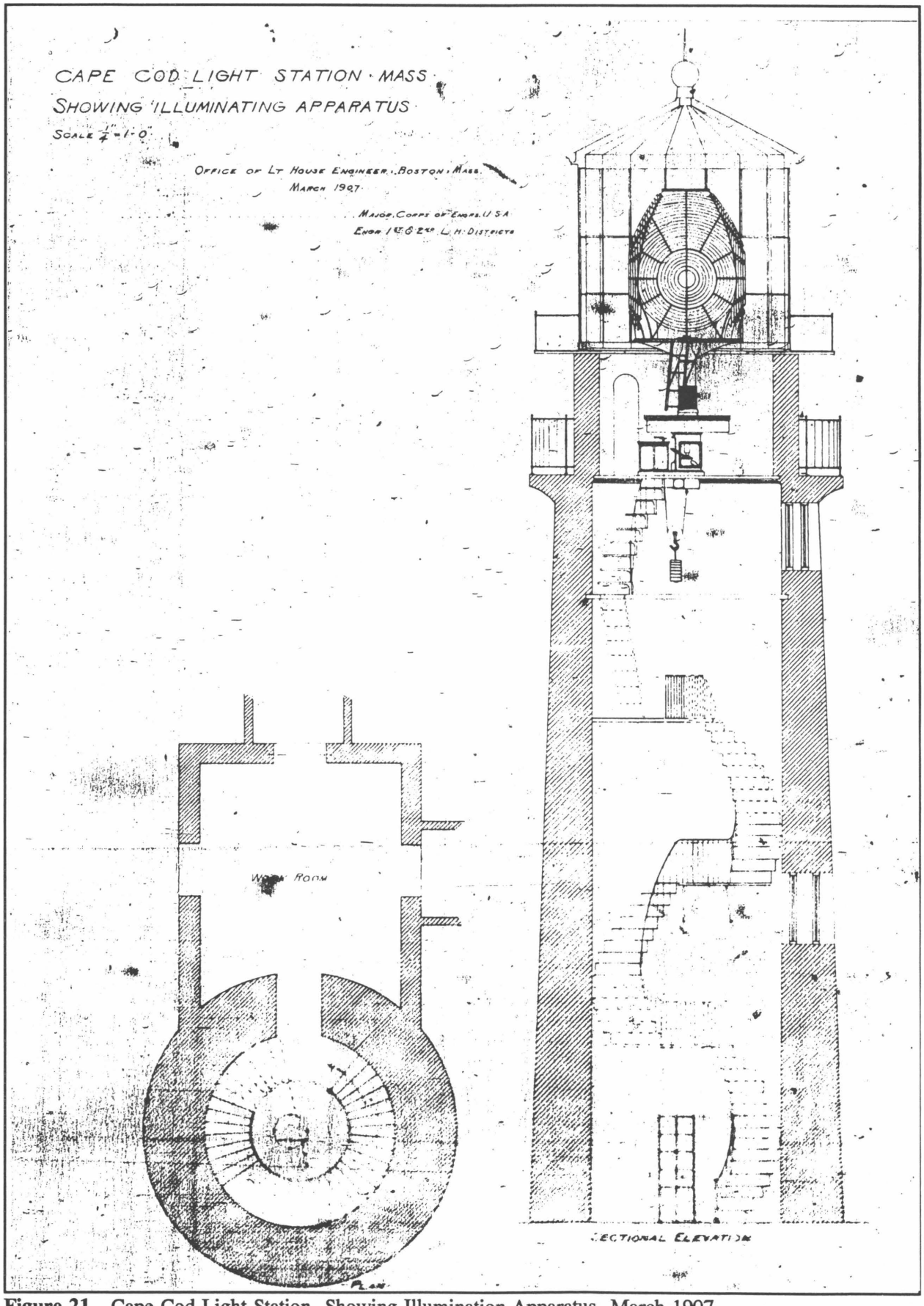


Figure 21. Cape Cod Light Station, Showing Illumination Apparatus, March 1907.

Alterations to the Site Circa 1900. A clipping-file entry from 1899 details changes made to the fog signal:

> A 4-horsepower Hornsby-Akroyd oil engine with Clayton compressor was installed in place of a worn out caloric engine. The interval between the lighting of the fire and the first blast of the whistle with the caloric engine was about forty-five minutes; with the new apparatus it is ten minutes. Various repairs were made.[95]

A clipping-file entry from 1900 reiterates this information, but goes further. It states that the installation of the four-horsepower engine completed "the installation of the fog-signal apparatus in duplicate. . . ."[96] It also says that a brick oil house was built south of the fog-signal building, and that a brick floor was laid in the nearby engine house.

A drawing from 1903 (app. P) entitled "Location of Wireless Telegraph Station at Cape Cod Light House" provides detailed information about the northwest corner of the site. Here the drawing depicts the "telegraph house," a cistern, a privy, a cesspool, an oil house, a dwelling with operations room, a mast, and "earth plates."[97] This drawing apparently was traced from the 1885 survey plan. It is not particularly accurate concerning structures farther south, in the vicinity of the lighthouse. This is based on the fact that the drawing shows fewer buildings there than are known (from the documentation) to have existed. It may be that, since the focus of the 1903 drawing was the northwest corner of the site, the accuracy of the southern half of the property was thought to be unimportant. An additional oil house was built in 1904.

Alterations after Circa 1900. The Coast Guard CEU maintains a series of similar documents in their collection that are initially entitled "Description of Light-House Tower, Buildings, and Premises" in 1908, and by 1933 are called "Description of _____ Light Station." For Cape Cod, one such report exists for the years 1908, 1910, 1922 (some of the information in this year's form is crossed out and resubmitted for 1927), and 1933. It also appears that the person who conducted the survey in 1933 used the 1927 (and therefore the 1922) notations as his guide, based on the exact same entries presented in a new form. These reports provide a very detailed description of the site for the specified years, and they also permit comparisons to be made that distinguish when changes were made. Complete copies are included in Appendix R. An abridged version compiled from entries relating more specifically to the keeper's dwelling and the lighthouse tower is presented on the following pages.

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[95] July 3, 1899; Cape Cod, Mass., Book 1319, p. 2; Lighthouse Service List of General Correspondence 1791-1900; Clipping File; RG 26; NA/DC.

[96] Cape Cod, Mass., Entry #134; Clipping File; RG 26; NA/DC.

[97] "Location of Wireless Telegraph Station At Cape Cod Light House," drawn by C.E. Stumcke, Jr., May 20, 1903; Equipment Dept., U.S. Navy Yard, Boston.

While several of the 1908 entries are different from subsequent entries, it seems that the inspector may have been careless in his initial survey. Since no documentation has surfaced that records any major changes between 1908 and 1910, and since the same person surveyed the buildings two years later, his entries appear to be more exact in the latter descriptions.

PREMISES

1908	1910	1922	1927	1933
Described by: Lt. Col. Edw. Burr	Lt. Col. Edw. Burr	[?] 1st Asst. Supt.	C.H. Robinson, Assoc. L.H. Engineer	No entry
Date: April 23, 1908	March 21, 1910	February 7, 1922	June 8, 1927	1933
Character of light: Flashing white, every 5 seconds	Same	Same	Same	Same
Latitude: 42° 02' 23" **Longitude:** 70° 03' 40"	Same	Same	Same	Same
Site Area: 10 acres; **Inclosed:** 6 acres	10 acres, 47 poles; 10 acres, 47 poles	Same Whole	Same Same as 1922	Same Same as 1922
Tower from high water mark: 600 feet	580 feet	Same as 1910	Same as 1910	About 580 feet
Inclosure: Wire fence	Wood and wire fence	Wire concrete	Same as 1922	Wire concrete posts
Wharf or landing: none	Same	Same	Same	Same
Light reached by: road	Carriage	Public road	Same as 1922	Same as 1922

Distance to road, R.R. or landing: station on public road, 2 mi. to R.R. station	Tower is within 30 feet of public road	Post office N. Truro distant 1 1/2 miles	Same as 1922	Same as 1922
Last rebuilt: 1857	Same	Same	Same	Same
Condition: good	Same	No entry	No entry	No entry
Shape of tower plan: circular	Same	No entry	No entry	No entry
Tower form: conical	Same	No entry	No entry	No entry
Tower hgt. from base to vent. ball of lantern: 61 ft.	66' 2"	No entry	No entry	No entry
Focal plane hgt. above mean high water mark: 183 ft.	Same	Same	Same	Same
Tower color: white, by whitewash	White, by paint	White, by whitewash	Same as 1922	Same as 1922
Connection to keeper dwelling: covered way	Same	Same	Same	Same
Tower materials: brick	Bricks and cement	Same as 1910	Same as 1910	Same as 1910
Wall thickness at base: 42" **At parapet:** 30"	3' 7" 2' 2"	No entries	No entries	No entries

Tower at base - diameter: 11' Inside	14' 9"	No entry	No entry	No entry
Tower at parapet - diameter: 11' Inside	14' 9"	No entry	No entry	No entry
Stairway and Steps: cast iron	Circular	Iron	Same as 1922	Same as 1922
No. of stairway landings: 3	4	No entry	No entry	No entry
Window tower glass size: 8" x 10"	8" x 10" and 9" x 10 1/2"	Same as 1910	Same as 1910	Same as 1910
No. of tower wind.: 3 **Sizes:** Lower and upper sash 2' 3 3/4" by 22"	Same Both sashes 2' 3 1/2" by 22 1/2"	Same Same as 1910	Same Same as 1910	Same Same as 1910
No. of tower doors: 1 in tower, 1 in parapet	1	One, 3' 0" x 7' 0"	Same as 1922	Same as 1922
Foundation and depth: brick, 6 ft.	Bricks and cement	Concrete	Same as 1922	Same as 1922
Soil type: sandy **Protected by:** grass	Sandy loam Yes	Sandy	Same as 1922	Same as 1922

LANTERN AND LANTERN FIXTURES

1908	1910	1922	1927	1933
Order of lantern: first	Same	Same	Same	Same
Shape: polygonal	Same	Same	Same	Same
Diameter, inscribed to glass: 12 ft.	12' 1" **and in the clear:** 11' 9"	Not given	Same as 1922	Same as 1922
No. of sides in plan: 16	Same	Same	Same	Same
Bars: vertical	Same	Same, 1 1/8" thick	Same as 1922	Same
Hgt. glazed: 9' 6"	9' 11 1/2"	Same as 1910	9' 5 7/8"	Same as 1927
No. of panels in hgt.: 3	Same	Same	Same	Same
No. of plates in ea. side: 3	Same	Same	Same	Same
Thickness of plates: 1/4"	Same	Same	Same	Same
Size of diff. plates: 47 5/8" 39 3/8" x 28" 25 3/8"	Bottom: 25 1/2" Mid: 39" Top: 47 1/2" x 28"	None given	Top row: 47 5/8" Mid. row: 39" x 28" Bottom row: 25" 16 lts. ea.	Same as 1927
Storm panes: none	Same	No entry	No entry	No entry
Lantern materials: cast iron	Iron and glass	Iron	Same as 1922	Same as 1922
Roof materials: cast iron	Iron	Same as 1910	Same as 1910	Same as 1910

Ventilator ball materials: cast iron	Iron	Same as 1910	Same as 1910	Same as 1910
Lightning-conductor spindle: rough iron - copper tip	Copper, platinum tip	Same as 1910	Copper, platinum tip, and grounded	Same as 1927
Lightning conductor: copper to lantern, led down side of tower, 4 ft. into ground	Soft copper 1/8" x 1 1/2" attached to lantern, stapled down side of tower, into pit filled with [c??e] about 30' away & 6' deep	No entry	No entry	No entry
Balustrade and outside gallery: stone gallery deck 24" W, w/iron railing of two rails and 1 1/4 round posts and 1/2" sq. balusters	Iron	Yes	Same as 1922	Same as 1922
Lantern doors: no door in lantern; balcony reached from watchroom, which has double doors	Hinges and latch	Iron, hinged with latch	Same as 1922	Same as 1922
Lantern floor: cast iron	Iron	Same as 1910	Same as 1910	Same as 1910
Watchroom door into lantern: no door; lantern entered by iron spiral stair	Hinges and handle	Same as 1910	Same as 1910	Same as 1910

Parapet: 10' 4"	Circular, 10' diam.	No entry	No entry	No entry

VENTILATORS

1908	1910	1922	1927	1933
Location: lower part of lantern	Same	Same	Same	Same
Lantern ladders outside: none	Iron	Same as 1910	Same as 1910	Same as 1910
Curtain hooks inside lantern: spring roller curtains	Same	Same	Same	Same

WATCHROOM

1908	1910	1922	1927	1933
Fitted: revolving clock & stove	Pedestal and heating stove, sides sheathed and finished bright	Pedestal and heating stove, sides sheathed	Pedestal, and sides sheathed	Same as 1927
Communication: speaking tube	Same	Same	Telephone	None
To where: 3 dwellings	To dwellings	To two dwellings	Same as 1922	

ILLUMINATING APPARATUS, ETC.

1908	1910	1922	1927	1933
Maker: Barbier & Benard **Year:** 1901	Same Same	Same Same	Same Same	Same as 1927 Same
Marks & No. on apparatus: Phares & Fanux Paris	No. 25767	Paris	Barbier, Bernard and Turenne	Same as 1922
Order: 1st **Inside diameter of central drum:** 6'	Same 6' 1/2"	Same Same as 1910	Same Same as 1910	Same Same as 1910
Characteristic: white flash every 3 seconds	Flash every 5 seconds	Flashing white, 580,000 intensity in English candles	Same as 1922	Flashing white, 4,000,000 intensity in English candles
Time of revolution: 20 seconds	Same	Same	Same	Same
Intervals between flashes: 5 seconds	4.1/2 seconds	**(Duration of eclipse):** 4.8 seconds	Same as 1922	Same as 1922
Duration of flash: 1/2 second	Same	0.2 seconds	Same as 1922	Same as 1922
Panels in lens apparatus: 4	28	Same as 1910	Same as 1910	Same as 1910
No. flash panels: 4	Same **Arc of each:** 90°	Same as 1910	Same as 1910	Same as 1910
Elements in each panel of lens' central drum: 9	8	Same as 1910	Same as 1910	Same as 1910

Prisms in each panel above lens' central drum: 18	Same	Same, they are flashing	Same as 1922	Same as 1922
Prisms in each panel below lens' central drum: 8	Same	Same, they are flashing	Same as 1922	Same as 1922
Flashes produced: by whole apparatus revolving	Same	Same	Same	Same
Pedestal: special pedestal w/ mercury float	Cast-iron supporting clock and mercury float	Cast iron	Same as 1922	Same as 1922
Service table: none	In work room on ground story	No entry	No entry	No entry
Off-gassing and draft tube: regular 1st order connecting tube	Black iron 7 1/8" D. held in place by collar	Same as 1910	Same as 1910	Black iron 7 1/8" D. held in [space] by [cellar] Same as 1910?
Revolving machinery: rotary carriage, w/ mercury float operated by clock-work	Clockwork	No entry	No entry	No entry

Revolving on: mercury	Same	Mercury float, 5' 7 1/4" inside D. of trough; 10" inside depth of trough; 5' 7" outside D. of float; 11 1/2" depth of float; 600 pounds of mercury required, not renewed since 1901	Same as 1922	Same as 1922
Revolving cord or chain-how led: cord, drops directly from drum	By traveling pulley	No entry	No entry	No entry
Length of drop tube: no tube, open tower w/ guard for weight, 47' drop	Weights face into stairwell and have guard at bottom, could drop 25 feet if necessary	No tube, weight goes in stairwell, about 200 pounds	Same as 1922	Same as 1922
Time revolving machinery runs after 1 winding: 2 1/4 hrs.	Same	Same	Same	Same
Machinery protection: iron frame with glass	Glass case, brass frame	Glass case	Same as 1922	Same as 1922
Regulated by: governor	By flyball governor and weights	By friction fly ball governor	Same as 1922	Same as 1922

LAMPS AND BURNERS

1908	1910	1922	1927	1933
Lamp & no. of wicks to burner: first order plunger lamp w/ 5 wicks	1" order, 5 wicks, 4 3/8" D. of outside wick	55mm I.Q.V., illuminated with Kerosene, 580,000 English candle intensity; one mantle, 2 1/8" D.	Same as 1922	1000 watt P.S.52 - clear C-7 filament, electric incandescent illuminant-1670 intensity in English candles
Spare lamps: 1	No answer	Two	Same as 1922	Four
Spare lamp burners: 3	1	----	Same as 1922	Same as 1922

CLOSETS IN TOWER

1908	1910	1922	1927	1933
How used: none	Same	Same	Same	Same

DWELLINGS FOR KEEPERS

1908	1910	1922	1927	1933
Location to light-house: connected by covered way to tower	Single dwelling north of tower	Same as 1910	Same as 1910	Same as 1910
Coloring: white	Same	White, lead trimmings	Same as 1922	Same as 1922
Materials: wood	Same	Same	Same	Same
No. rooms in each dwelling: 6 in Keeper's	Same	Same	6 plus bath	Same as 1927
Heating plant: no entry	Same	Direct hot water	Same as 1922	Same as 1922
Furnished quarters: no entry	Same	All keepers	Same as 1922	Same as 1922
No. of keepers and assts. to each dwelling: 1 keeper single dwelling	Same	Same	Same	Same
Outhouses: No entry	4, painted white with lead-colored trimmings	Two fuel houses and pump house, w/white lead trim.	Same as 1922	Same as 1922

Data for dwelling furnishings - **Stove maker:** no entry **Stove size:** no entry **Sink maker:** no entry **Sink size:** no entry **Pump maker:** no entry **Pump size:** no entry	Same as 1908 ↓	Magee Grand 7-18 Not known 22" x 48" Douglas No. 2	Same as 1922 ↓	Same as 1922 ↓

WATER FOR DRINKING AND DOMESTIC USES

1908	1910	1922	1927	1933
How procured: rain water from bldg. roofs	Caught on roofs; and from a deep well	From deep driven well and from roofs	Same as 1922	Same as 1922
Quality: good	Same	Same	Same	Same
Ample quantity at all seasons: no	Ample	Same as 1910	Same as 1910	Same as 1910
Insurance of purity: cleaning cistern	Cleaning often, washing roof in first of rain fall	Frequent cleaning	Same as 1922	Same as 1922
Capacity of tank or cistern: 1500 gal. in cellar	In each cellar of dwellings, about 1200 gals. ea.	Cisterns in each dwelling 1200 gals.	Same as 1922	Same as 1922
Material of tank or cistern: brick	Bricks and mortar	Bricks cement plastered	Same as 1922	Same as 1922
Water obtained by: pump	Pump operated by gas engine	Same as 1910	Pump powered by kerosene engine	Same as 1922
Distance from keeper's dwelling: in dwelling	16 feet	Same as 1910	Same as 1910	Same as 1910
Well description: no entry	4 1/2" D. iron pipe, 153' deep	4" D. iron pipe, driven well 153' deep	Same as 1922	Same as 1922

The 1899 floor plans of the keeper's dwelling were revised in 1909 for the addition of indoor plumbing. The revised first-floor plan, which was not specifically dated, shows that the kitchen sink was moved to the east end of the south wall (app. L). The revised second-floor plan, which was dated September 1909, was more clearly altered for the addition of a bathroom (app. S). Notes on the drawing record that old doors were reused, that the large dormer on the east side of the roof was added at this time. Confirmation of the installation of indoor plumbing is provided by another site drawing dated November 1909 (app. T), which shows a soil pipe leading from both of the dwellings to a cesspool, as well as the location of a driven well. This is confusing, given that the site descriptions do not mention the bathroom as an extra room in 1908, 1910, or 1922. It is not until 1927 that bathrooms are specifically noted.

Information based on site surveys obtained at the Civil Engineering Unit of the U.S. Coast Guard provided dates of building construction and demolition during the 20th century. The old engine house was torn down in 1908. In 1909, a concrete engine bed was installed for the fog-signal apparatus at the lighthouse.[98] During that year a foundation was poured for an air-compression tank, presumably for the fog signal.[99]

A drawing dated 1910 gives measurements for screen doors and window screens for the structures at Cape Cod Light Station (app. U). This drawing has been used to date historic photographs by the presence of window screens on the structures. Several of these photographs (figs. 22-25) date to the second and third decades of the 20th century, but evidence for more specific dates was not found. The photographs show that the trim was still painted a contrasting color during this period (gray, based on paint analysis), and the granite edge of the gallery continued to be whitewashed to match the tower. Based solely on photographic evidence, it was during this time that the exterior ladder from the Watch Gallery to the Lantern Gallery was altered from an angled position to a vertical position.

No additional documentation surfaced from the years 1910 to 1922. The Coast Guard's attention was most likely consumed by World War I. However, based on the station description forms, minor changes occurred during this time period. These included changing the enclosure fence from wood and wire to wire and concrete; changing the tower's foundation from bricks and cement to concrete; changing the duration of the eclipse or interval between flashes—from 5 seconds in 1908, to 4.5 seconds in 1910, to 4.8 seconds in 1922; and changing the duration of the flash from .5 seconds to 0.2 seconds. The lamps and burner system were changed to a 55-mm. incandescent oil vapor (I.O.V.) system fueled by kerosene. The method of heating may have been changed to direct hot water. Data for the dwelling furnishings (i.e., stove, sink, and pump) were supplied for the first time, but it does not necessarily suggest that changes were being made.

Likewise, very little changed between 1922 and 1927. Again based on the station description forms, a telephone connecting the tower's Watch Deck with the keepers' dwellings replaced a

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[98] Concrete Engine Bed, 1909; drawing #1561; USCG CEU Providence; Warwick, RI.

[99] Drawing #1548; USCG CEU Providence; Warwick, RI.

speaking tube as the means of communication, and the engine for the water pump was changed from a gas to a kerosene type.

A recreation room and drill building were erected somewhere in 1927. These buildings were not necessarily on the lighthouse property; they could have been part of the nearby Highland Lifesaving Station site, or at the telegraph house's site north of the lighthouse complex. A new well was dug in 1928.[100]

Four undated historic photographs (figs. 26-29) reflect a change in roofing materials on the dwellings and connector buildings, to hexagonal shingles probably made of asphalt. Based on the automobiles in the pictures, and on the absence of wooden siding shingles on the buildings (known to have existed in 1936), this series of photographs probably dates from the 1920's to the mid-1930's. The first photograph reflects no obvious change in roofing materials, but the clarity of the image is poor. The new roofing is very evident in the later three images. The third in the series (fig. 28) also shows that a porch element was changed from open bracing to an enclosed skirt with latticework camouflaging the foundation.

By 1932, plans were being drawn for electrifying the station (app. V). It is difficult to discern if these plans implied that the whole station would be electrified for the first time, or if only the tower light (or lamp) would be converted. The plan for cable locations suggests that cable came from the main feed (pole) to the fog-signal house, and then fed power to the tower and to the main keeper's dwelling only. Later documentation confirms that these cables were underground. On the other hand, one notation records that in the tower lantern: "6 - T.14-250 watt lamps, 60° apart on 4" circle replaced by 1000 watt P.S. 52 d. bulb." This infers that the lantern had already been outfitted with electric bulbs, but was perhaps powered electrically from a generator. No documentation has surfaced to pinpoint when this conversion took place, and the station descriptions for 1922 and 1927 document the lamp as one (55mm I.O.V. with a mantle) fueled with kerosene. The station description for 1933 clearly agrees with the specifications on the 1932 plan: the lamp is a 1000 watt P.S.52 - clear C-7 filament, electric incandescent illuminant, with an intensity of 1670 English candles. One additional piece of information derived from this drawing is that the clockworks and weight through the floor of the watchroom (see fig. 21) were no longer needed to operate the illuminating apparatus. The apparatus was now entirely powered by a motor.

A 1945 drawing showed the type of lamp and lamp stand at Cape Cod Light Station (app. W). These details were traced from the 1932 electrification plan, with the necessary changes made. By then only one light bulb was needed for the main light, instead of the two depicted in the 1932 drawing. The later drawing may have been made in preparation for changing the illuminating apparatus: a new plan was submitted and approved during the winter of 1946 for the replacement of the first-order lens with a 36-inch drum rotating beacon (app. X). This drawing indicates that the work included the installation of a new steel floor plate over the original deck ring. The new plate was 10 1/2 feet in diameter and three-eighths of an inch thick, in three sections. Its addition was necessary because the deck ring had a center opening 7 feet in diameter—appropriate for the large

[100] Property Data Itemization Supplement to Form N-USO-13, December 10, 1943; files, USCG CEU Providence; Warwick, RI.

first-order Fresnel lens that was being removed, but far too large for the new Crouse-Hinds 36-inch, double-drum rotary beacon being installed. (A hole only 3 inches in diameter had to be cut in the center of the plate for the new beacon's drive shaft.) A somewhat larger opening was created to access the Watch Deck below.

Documents indicate that a radio beacon was installed northeast of the keeper's dwelling in 1932, and that a pump house was erected in 1937, possibly immediately to the east of the keeper's dwelling, over the location of the well. A property data itemization form from 1938 provides the following information for that year: tennis courts were added, again possibly at the lifesaving station or telegraph site; electrical systems were improved; and a water tank and a fence were added.

At some point prior to 1936, the frame structures were sided with wooden shingles. This is known from a snapshot dated 1936 found in the Coast Guard files that shows this change.[101] Three somewhat later photographs (figs. 30-32) reflect both the 1932 radio-beacon installation and the new wood-shingle siding. All of these photographs predate 1946, based on the presence of curtains (in closed position) in the Lantern; they indicate that the Fresnel lens, which was replaced in 1946, was still present.[102] Judging by the style of automobiles in the images, the first photograph can be dated to the late 1930's or 1940's, and the other two to the mid-1940's. The latter two images show that the staff attached to the lantern, believed to be the Kane signal staff that was installed in 1898, was removed by this time. No documentation recorded its removal.

These three photographs are the first to show the connecting structures after they were painted to contrast with the color of the dwellings. It is thought that the same color (most likely white) was used on all of the structures immediately after the dwellings were sided with clapboards in 1881. In the years thereafter, the brick tower continued to be whitewashed, but the frame dwellings were often painted a different color, and the brick connecting structures were always painted to match the dwellings. After the dwellings were sided with shingles circa 1930, however, the connecting buildings were always painted to match the color of the tower.

It is likely that a garage was built between 1943 and 1947, or was created by the conversion of the former barn (see figure 32). The garage is not included in a survey from 1943, but it is in the survey from 1947.[103] Based on blueprints, a pilot-balloon observation platform was constructed in 1944 and attached to the brick oil house south of the fog-signal building.

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[101] "Antenna - C. Cod Radiobeacon," drawing dated 7-1-36; files, USCG CEU Providence; Warwick, RI.

[102] "Curtains were *only* used to cover classical Fresnel lenses, since sunlight focused back through the glass prisms would cause enormous heat in the center of the lens, as well as discoloring of the glass prisms. Curtains or lens covers were *not* used with modern rotating beacons such as the DCB-36." Entry in transmittal letter of HSR draft comments, USCG Lieutenant-Commander Dan R. May to CRC Manager Myra F. Harrison, June 20, 1994.

[103] Proceedings by Special Board of Survey, February 7, 1947; files, USCG CEU Providence; Warwick, RI.



Figure 22. Cape Cod Light, looking north, between 1910 and circa 1920.



Figure 23. Ballplaying in field southwest of Cape Cod Light, between 1910 and circa 1920.



Figure 24. Cape Cod Light, looking east, between 1910 and circa 1920.



Figure 25. Cape Cod Light, looking west, between 1910 and circa 1920.



Figure 26. Cape Cod Light, looking southwest, circa 1925.



Figure 27. Cape Cod Light, looking north, between circa 1930 and circa 1935.



Figure 28. Cape Cod Light, looking south, between circa 1930 and circa 1935.



Figure 29. Cape Cod Light, looking east, circa 1935.



Figure 30. Cape Cod Light, looking south, between circa 1935 and 1946.



Figure 31. Cape Cod Light, looking north, before 1946.



Figure 32. Cape Cod Light, after 1944 and before 1946.

1947 to Present

The U.S. Coast Guard

The Coast Guard, as stated previously, was made responsible for aids to navigation in 1939. Technical improvements in lighthouse operation—especially automation—have continued at a rapid pace since that time, despite frequent internal Coast Guard reorganizations. Reflecting this increased complexity, the concept of a Light Station evolved and eventually became a formal designation.[104] This recognized that the lighthouse no longer could be viewed as an isolated entity, but was part of a complex that might include dwellings, utility buildings, boats, fog signals, and radio apparatus. This emphasis was visible at Cape Cod Light.

As was the case with its predecessor agencies, the Coast Guard divided the country administratively into a number of districts. The frequent internal reorganizations of the Coast Guard lie outside the scope of this study. At the present time, Highland Light is administered by three units of the Coast Guard. The overall operation and administration of the site is the responsibility of Group Woods Hole (Woods Hole, MA); the authority for aids to navigation rests with the First Coast Guard District Office (Boston, MA); and the management of real property is under the supervision of the Civil Engineering Unit Providence (Warwick, RI).

Activities at the Highland Light

A 1949 Report of Attended Light Stations documented that the light at Cape Cod Station then flashed for 0.35 seconds, and that the eclipse or interval between flashes was 4.65 seconds. It was also noted at that time that the station exterior was painted, and that the light tower was painted and whitewashed throughout.[105] Figure 33 shows the site after 1946 but before 1956. These dates are based on the absence of lantern curtains and the presence of the garage, which was demolished in 1956.

A smattering of archival material shows that several inspections took place at the site in 1950. A report titled *Cape Cod Light* and hand-dated 1950 (no month or day) indicates that for the light tower:

> The tower structure is in good condition and well painted. The two windows at ground level show evidences of rot in the sills, sash and frames which should be replaced although the need is not urgent. The crew will replace a few shingles that are missing. In the passageway connecting the tower to the two dwellings there are spots where the plaster should be replaced. The station crew will accomplish this work, using plasterboard

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[104] Holland, draft National Historic Landmark nomination, Chap. 5.

[105] Report of Attended Light Stations, September? 1949; Box File, USCG Region I, Major Aids to Navigation, 1900-1962, Box 17, Massachusetts (Box File); RG 26; NA/MA.

to make the repairs. The door on the South side of this passageway is in poor condition but does not require immediate replacement. Approximately four feet of gutter along this passageway is rotten.

The lantern lens and lens drive are in good condition with the following exceptions. One of the coupling screws is sheared off and the station does not have the proper tools to effect replacement.

The upper balcony is in good condition as is the lower balcony except for a few railing verticals that are eaten away. These are now will [sic] painted which should check further corrosion.

There are several cracked lantern panes but they do not leak to any appreciable degree so replacement is not warranted at this time.[106]

Similar information was supplied for the single dwelling, including the notation that the chimneys, roof, walls and foundation, galley range and sink, boiler, framing, and floors were in good condition:

The gutters are in satisfactory condition but the trim at the ends of the ridge roof is rotten.

The plaster on the porch ceiling is falling off and should be replaced. The ceiling is not flat but changes slope at about its center so a flexible type of wallboard should be used to effect replacement.

The plaster on the galley walls is loose from the lath but is otherwise sound and does not require replacement at this time. The wall plaster is sound . . .

The outside door to the galley is in fair condition. Replacement is not urgent.

The finish coat of plaster is peeling off in spots on the stairway to the second floor.

The plaster is loose in places in two bedrooms and will be replaced with sheet rock by the crew.

The door frame at the bottom of the bulkhead entrance to the basement is rotten . . .

There are no leaks in the heating or water piping except a slight leak where the piping connects to the boiler. The water pressure is poor and some rust often comes through when the water is first turned on so the building should be repiped in the near future. . . .

The light fixtures are old and the station has recently had two short circuits in the wiring. An electrician should go over the wiring and replace any that has poor insulation.

The smoke pipe between the boiler and the chimney is rusted out and will be replaced by the station crew.

The windows in this building are in satisfactory condition.[107]

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[106] "Cape Cod Light," report hand-dated 1950; Box File; RG 26; NA/MA.

[107] See footnote 106.

A single page dated August 3, 1950, and possibly originally attached to the above report, notes that the station was in excellent condition, despite being short four crew members: "Crew was in process of painting tower inside and out. . . . Storm windows and screens are needed for the single dwelling, and an oil or gas range is recommended for cooking (to replace the old coal stove). R.J. Carson"[108]

On August 1, an inspection report was submitted that confirmed that the aids to navigation were in generally good working order, that the condition of the structures was good, that the tower and dwelling were protected against lightning with suitable lightning rods, and that a modern sanitary system was installed in all dwellings. The major noted deficiency regarding living conditions was that the water from the deep well had not been analyzed lately for purity.[109] The inspector's report to the Commander of the 1st Coast Guard District included the lack of water analysis among other deficiencies, one of which was that the cellar stair had no top landing. In addition, the inspector commented that the station, including the lifeboat station, "quartered and subsisted" 11 men for both the light station and the lifeboat station, all living in the "three old keeper's dwellings. The remaining two are unused and vacant except for coal ranges in galley."[110] Two (other?) dwellings were showing rapid deterioration, and possibly were those related to the original telegraph and lifesaving sites. Only one tub and no shower was available to these 11 men, which was probably neither convenient nor sanitary. Cooking depended on getting the draft needed to operate the coal-burning kitchen range, so poor weather conditions affected "proper and prompt preparation of meals."[111]

The Commander of the 1st Coast Guard District informed the Commandant (INS) at the end of September that a water analysis would be made, and the cellar door would be relocated to swing outward. In addition, a study would be made about constructing a cellar landing and replacing the coal-burning range with an oil-fired range. A shower was to be installed as soon as funds were available, without additional study. The two apparently surplus buildings, whichever ones they were, would have to wait until wartime requirement issues were resolved, when a decision could then be made regarding their salvage possibilities.[112]

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[108] See footnote 106.

[109] Inspection report by G.W. McKean, Captain, Eastern Inspector, 1 August, 1950; Box File; RG 26; NA/MA.

[110] Memorandum, Eastern Inspector to Commander, 1st CG District, 11 August 1950; Box File; RG 26; NA/MA. The fact that the crews of the light station and the lifeboat station were considered together reflects the way in which administrative and technological changes gradually caused the originally separate lightkeeping and lifesaving functions to come together within an expanding U.S. Coast Guard.

[111] See footnote 110.

[112] Memorandum, Commander, 1st CG District, to Commandant (INS), 28 September, 1950; Box File; RG 26; NA/MA.

Wartime (World War II) requirement issues may have been resolved by 1952. On March 7 of that year, a Board of Survey decided that the double keepers' dwelling with five rooms and a bath on each side was not to be disposed of at this time, but that the barn (or garage) was worthless.[113]

Inspection records from the same year provide a less pleasing picture of the station. The inspector, who was the Chief of the Aids to Navigation Section, reported that:

> 1. [Not applicable]
>
> 2. The old quarters (Keeper's house) were dingy and grimy and poorly stowed. Bath room was dirty. The double dwelling vacant at present was indifferently secured and showed some evidence of interior deterioration. If not needed for beach patrol it should be surveyed for demolition and removal.
>
> 3. Inside whitewash of light tower showed considerable evidence of flaking. Lens drive was very noisy.
>
> 4. Fog signal oscillators have been removed inboard because of bank caving in, due to erosion undermining.[114]

The inspector recommended that the double dwelling either be disposed of or properly secured and preserved; that the keeper's dwelling be cleaned and modernized with "linotile," woodwork, and paint, etc.; and that the interior of the tower be repainted with whitewash.[115] A single page, labeled "(p. 4)" but with no previous pages, and signed with the same name (W.B. Chiswell) as the 1952 inspector, notes that the "Crouse Hinds beacon was excessively noisy although bearings had just be (sic) renewed," that the "cliff in front of light is undercutting rapidly from sea action," and that the "Light & Dwelling are in general good condition and repair."[116]

The Coast Guard may have accomplished some postwar reorganization in 1952, because the status of Highland (Cape Cod) Light was changed at that time from a "sub-unit of Lifeboat Station,

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[113] Proceedings of Board of Survey, D-32-52, March 7, 1952; files, USCG CEU Providence; Warwick, RI.

[114] Memorandum, Chief, Aids to Navigation Section, to Chief of Staff, via Chief, Operations Division, May 20, 1952; Box File; RG 26; NA/MA.

[115] See footnote 114.

[116] W.B. Chiswell, no date; Box File; RG 26; NA/MA.

Cape Cod to that of a separate district unit in Group Race Point."[117] An additional note clarified that Group Race Point was now also renamed as Group Cape Cod, and that the site should be redesignated as "Light Station (Lookout) Cape Cod, Mass."[118]

The barn/garage was demolished in 1956. A storage shed and an outhouse were torn down in 1957.

In mid-August of 1957, specifications were submitted for changing the heating and domestic hot-water system at Highland Light. The description was "intended as a guide in converting the existing coal fired gravity circulating heating system to a closed, forced system of hot water heating complete with 'year around' domestic hot water, automatic controls, with all appurtenances, etc."[119] The new heating system probably replaced the system that dated to the turn of the century when the major renovations occurred at the station.

An undated "Allowance List" references the "Cape Cod Light and Lookout Station."[120] This list postdates 1952, due to the official wording of the site's name, and predates 1957, due to the fuel source named for the heating system. The list noted that the lens was still a 36-inch Crouse-Hinds double-drum beacon, and that the main illuminant was an electric lamp with 1,000 watts, 120 volts, and a T-20-C13 filament. It also provided measurements for storm panes, presumably for the lantern, since the measurements matched those provided for the same in the site survey of 1927, except that only two each are listed. Listed dwelling equipment included heating systems for all three dwellings (all fueled by nut coal), cooking ranges, refrigerators, etc. Only the heating systems were specifically categorized by dwelling. The keeper's dwelling retained a system manufactured by H.B. Smith, size W-26-5. Two cooking ranges in the dwellings were Queen Atlantic No. 308's, also fueled by nut coal, and a third was a Caloric Gas Range, Model D7468U, fueled by bottled gas. It is unknown which ranges were located in which dwelling. Only one hot-water heater was listed: a 45-gallon model made by A.O. Smith Corp., Kankakee, IL, Model PG-45.

In April 1958, the Safety Board at Cape Cod Light Station recommended that a new railing for the weight deck in the light tower be fabricated, and that several places needed welding at the outside "catwalk" railing.[121] It is not known if the latter work related to the railing of the watch gallery or that of the lantern gallery, since both railings have since been altered. A new fog signal

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[117] Memorandum, Commander 1st CG District, to Commander CG Group, Cape Cod, June 9, 1952; file A 4-2; Box File; RG 26; NA/MA.

[118] See footnote 117.

[119] Specifications and cover sheet from H.D. Wear, AAC Chief, Civil Engineering Section, August 15, 1957; Box File; RG 26; NA/MA.

[120] Allowance List, USCG Cape Cod Light and Lookout Station, form #CG-9946A (8-46), no date; Box File; RG 26; NA/MA.

[121] Memorandum, Commander, First CG District (by direction H.B. Wear), to Commanding Officer, CG Base, Woods Hole, Mass., L9-3, April 29, 1958; Box File; RG 26; NA/MA.

(not building) was added in 1958, since the earlier signal horns and their concrete footing were being threatened by erosion.

Two photographs show the site in the late 1950's. Figure 34 is dated 1959. Figure 35 postdates 1958, based on the presence of the new fog signal, but predates 1961, based on the presence of the old assistant keepers' dwelling. Figure 35 indicates that the pilot-balloon observation platform attached to the brick oil house south of the fog signal building had been removed by that time.

A full set of plans was drawn in 1959 for a modern double dwelling and labeled "Family Quarters."[122] A Board of Survey was requested to be convened nine months later in order to establish the status of the existing, unoccupied double (assistant keepers') dwelling at Cape Cod Light Station, which had been authorized for retention in a no-repair status in 1952.[123] By September 1960, the structure had been declared excess real property,[124] and the demolition contract was awarded to James M. Silva of Provincetown by the end of 1961, based on the findings of the Board of Survey Report.[125] For the first time in more than a century, the lighthouse complex would be without one third of its connected triumvirate, and the tower and keeper's dwelling would stand alone. A new modern duplex, the "Family Quarters," was constructed as an unattached unit and completed in 1963.[126]

Two photographs show the completed duplex, as well as changes made to the keeper's dwelling and other structures on the site. The earlier of the two images is a postcard, which was not reproduced here because it is so indistinct.[127] The later photograph (fig. 36) postdates 1966, because it does not show the lookout tower, which was demolished that year.[128] It was taken before circa 1977, however, because it shows the fog-signal building and paint locker near the cliff, which were approved for demolition in 1977.

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[122] "Family Quarters - Three Bedroom," drawings 1-14, dated 9/11/59; drawing files, CG Dwgs. #107211-107220; USCG CEU Providence; Warwick, RI.

[123] Memorandum, D.J. Lucinski, District Comptroller, to? Chief, Civil Engineering Section, A20, June 28, 1960; Major Aids to Navigation; RG 26; NA/DC.

[124] Report of Excess Real Property, September 2, 1960; USCG CEU Providence; Warwick, RI.

[125] Report of Changes to Federal Real Property, December 29, 1961; USCG CEU Providence; Warwick, RI.

[126] Report of Changes to Federal Real Property, June 24, 1963; and drawing file, New Family Quarters Plot Plan, CG Dwg. #5477, April 25, 1961 (last revision "Corrected to 'As Built' Drawing," March 8, 1963. USCG CEU Providence; Warwick, RI.

[127] Published by Cape Cod Photos, Orleans, MA; undated, but postdates 1963 demolition of assistant keepers' dwelling and completion of new duplex structure. Research files, Cultural Resources Center (CRC), National Park Service (NPS).

[128] Report of Changes to Federal Real Property, June 2, 1966; USCG CEU Providence; Warwick, RI.

Figure 36 reveals that the main doorway of the keeper's dwelling had by that time been returned to its original location. If one looks carefully at the image, one can see that the entrance steps have been moved to the south bay of the main block of the dwelling's west elevation. The extant hood and partial porch enclosure at this doorway were not added at this time. Figure 36 also shows that the large 1932 tower for the radio direction-finder beacon was replaced with a smaller one in the same location after 1966.

An internal telephone system must have replaced the old marine telegraph system, because a Board of Survey suggested removing the telephone communication between Race Point LBS (Life Boat Station) and Cape Cod L/S (Light Station) in 1964. The reason for the suggestion included the fact the commercial telephone service had recently become available in the area even though the majority of poles had been installed in 1938 and 1939.[129]

Erosion had always been a problem at the site, as mentioned in several reports throughout the years. A 1971 Board of Survey Report documented that the original 1796 land acquisition at Cape Cod Light amounted to 10 acres, and found "that the ocean side of the property has a constant slow erosion problem." (In addition, it documented that this site had a manned light.) The board was of the opinion "that an up-to-date land survey would reflect considerably less acreage that the 10.0 acres shown in the present records."[130] The Coast Guard's District Civil Engineering Unit contains five different Record of Erosion plans, the first dating to September 1973, the last dating to April 1986. While several of these drawings may have addressed the rate of erosion, none of them record the number of remaining acres.[131] It is curious to note that the land survey completed in 1885 records the amount of land to the edge of the bluff as 4.822 acres (see fig. 10).

The 1976 Annual Report of Real Property almost casually recorded that the name of the station was officially changed.[132] The name of "Highland LTSTA" (or light station) was now official. Documentation clearly shows that throughout the years the station was recognized by two names, Cape Cod Light (the official name since 1797) and Highland Light. However, the former may have become too confusing as many additional lighthouses were built on Cape Cod. What is interesting is that the official name change occurred as late as it did.

The 1976 Annual Report also contains the fact that a ladder and safety-rail assembly were installed.[133] This may refer to the exterior ladder that currently ascends from the watch gallery to the lantern gallery. This assumption is based solely on the fact that the ladder dies not appear in the 1959 photograph (fig. 32), but is evident in the post-1966 photograph (fig. 36).

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[129] Board of Survey No. D-17-64, April 30, 1964; USCG CEU Providence; Warwick, RI.

[130] Board of Survey Report, March 29, 1971; USCG CEU Providence; Warwick, RI.

[131] Record of Erosion: September 21, 1973; August 11, 1975; December 6, 1978; July 8, 1985; and April 22, 1986. Drawing files; USCG CEU Providence; Warwick, RI.

[132] Annual Report of Real Property, November 18, 1976; files, USCG CEU Providence; Warwick, RI.

[133] See footnote 132.

As stated previously, the fog-signal building and the paint locker were approved for demolition in 1977. The Record of Erosion drawing dating to December 6, 1978, does not show the outbuildings, confirming that they had been razed by that time.

The hood and partial porch enclosure at the main doorway of the keeper's dwelling, as explained earlier, were not built when the doorway was reestablished as the main doorway prior to 1966. The date of the hood and enclosure is unknown, but documentation found in National Register nomination forms suggests that they were added after 1980.

The last documented changes took place when the beacon was replaced with a fully automated signal. Drawings from June 1987 provide for the installation of the Crouse-Hinds DCB-224 rotating beacon and the supporting equipment necessary to operate it. (Two of the 24 drawings are included as Appendix Y.) Most of the equipment required to support the operation of the beacon is housed in the first adjoining room immediately to the north of the tower. Other work specified in 1987 included: the tower's exterior galleries were sandblasted and painted; the east window opening in the room adjacent to the tower was bricked in; a large plate glass window in the west wall of the same room replaced the smaller, original window opening; glass blocks replaced the double-hung sash in the tower's window openings; and the partition that prevented direct internal access from the tower to the keeper's dwelling was installed.[134]

Although no written documentation was found, a Coast Guard official related information regarding alterations to the keeper's dwelling.[135] Much of the interior had been renovated circa 1992, due to burst water pipes. The first story retains very little fabric that was not replaced at this time. Paint analysis confirmed a visual assessment: the only first-story interior elements that predate the circa-1992 renovation are the doorway surround and door of the main west entrance, and all of the trim associated with the stair hall, except for the one remaining door. More fabric was left intact on the second story, but it represents various periods, beginning with the 1900 renovation. (See appendix B, Paint Analysis.) It is believed that the windows and majority of exterior trim were replaced at this time, but the dwelling retained its shingle siding, and the tower and connecting structures remained painted.

Photographic evidence indicates that the exterior stair to the porch was relocated at some point from the west to the north side of the porch. This change occurred after 1946, based on figure 33. It may have occurred as late as 1992, based on the use of pressure-treated wood. Two first-story window openings also were removed: one from the north elevation of the ell, facing onto the porch, and one from the north wall of the north vestibule. Again, these alterations may have occurred as late as 1992, but their exact dates are unknown.

The smaller radio beacon evident in figure 36 was removed in 1992.[136]

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[134] Cat II Automation Plans, 24 drawings, June 15, 1987; drawing files; USCG CEU Providence, RI.

[135] Personal conversation with Senior Chief Petty Officer Chris Coleman, USCG, Provincetown, MA.

[136] Personal conversation with USCG Lieutenant-Commander Dan R. May.



Figure 33. Cape Cod Light, after 1946 and before 1956.



Figure 34. Cape Cod Light, looking north, 1959.

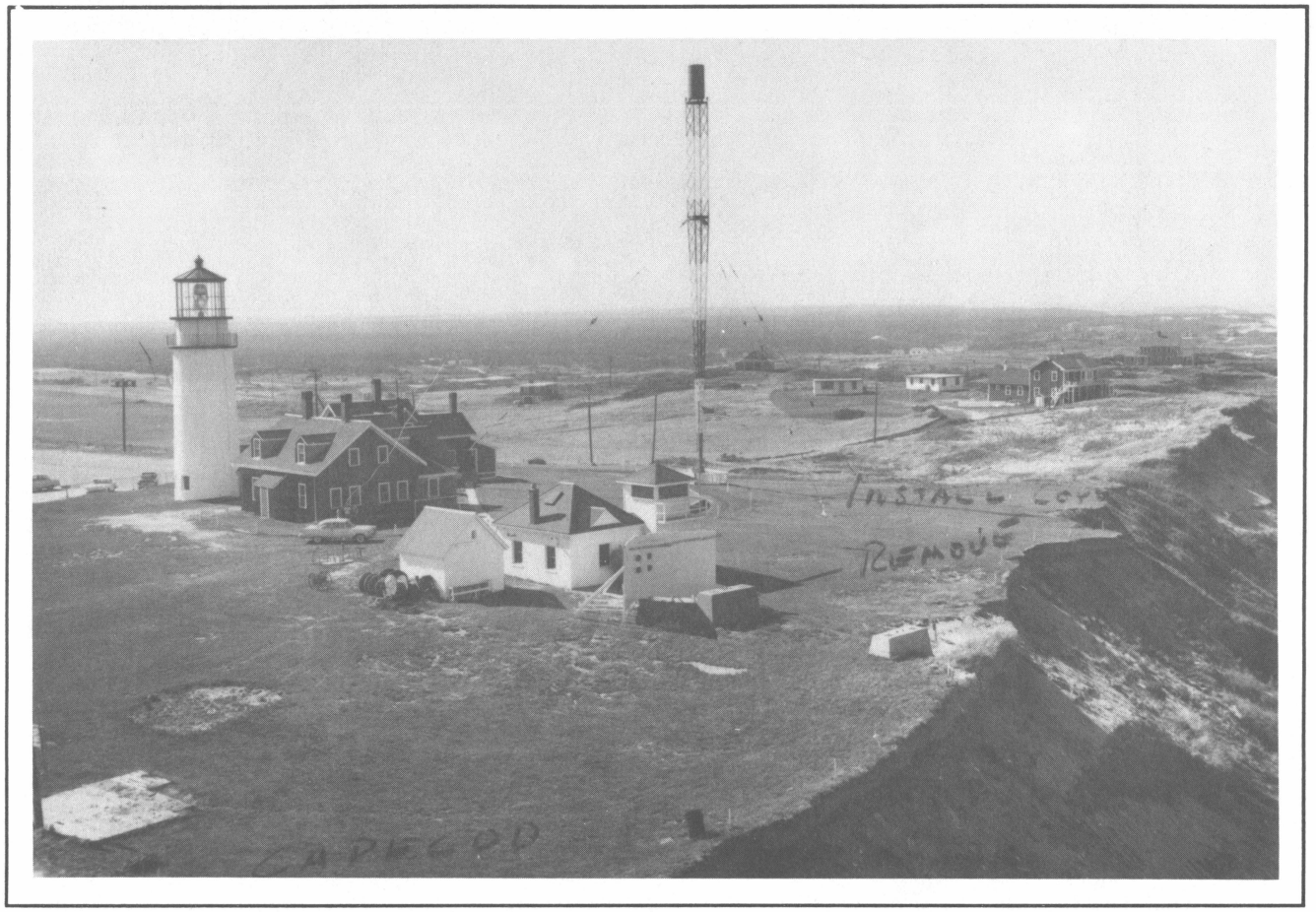


Figure 35. Cape Cod Light, after 1958 and before 1961.



Figure 36. Cape Cod Light, aerial photograph looking north, between 1966 and 1977.

Summary History of the Highland Light

The Highland Light site has been fully operational since 1797. It has been home to three consecutive light towers, providing continuous illumination from Cape Cod's eastern banks to seafarers for almost two centuries. Despite the many changes in the administration of the nation's aids to navigation, the beacon's importance to mariners has never lessened throughout its history. The beacon itself and its supporting structures have been replaced, altered, and/or repaired in order to meet changing requirements or technological advances. However, the footprints of the extant light tower, the keeper's dwelling, and the two passages that connect the two have never changed since the buildings' construction in 1856 and 1857.

The most obvious changes to the site in the 19th century were two-fold. One was operational: a fog signal was installed, along with two small supporting structures. The other was cosmetic: the original board-and-batten siding on the dwellings was replaced with clapboards.

Perhaps the most encompassing building changes, however, occurred in the first decade of the 20th century. At that time, the floor plans of both dwellings were completely reworked and dormers were added, the ell of the keeper's dwelling was raised to include a second story, and a porch was installed to wrap around two of the ell's sides. Shortly thereafter, a new Fresnel lens was installed in the tower, the beacon characteristic was changed from fixed to flashing, and a new iron staircase replaced the original spiral staircase that had wound around a center pole in the tower.

A series of alterations also occurred in the 1930's. The wood roofing material was replaced with asbestos shingles near the turn of the decade, and the dwellings' clapboards were replaced with shingles. A very large radio beacon tower was also erected during this time period. To the casual visitor, the 1932 electrification of the beacon would have been less evident. (The old Fresnel lens, which was retained to intensify the newly generated light, also concealed its source.) However, this replacement—more than any alteration—undoubtedly provided the most relief for the keepers from the labor-intensive job of keeping the old lamps fueled and lit. Even the 1947 installation of the Crouse-Hinds beacon, which was highly advanced technologically, may not have caused such a radical change in the keepers' routine.

Many buildings were added to and removed from the site during the Second World War and subsequent years. (A chart on the following page records the construction and demolition of the majority of the buildings affiliated with the operation of the extant light station.) In addition to the slow disappearance of site's supporting structures during this time frame, three changes occurred that had a dramatic impact on the site. First, the old assistant keepers' dwelling was razed in 1961 to make way for a new duplex dwelling for Coast Guard personnel, which greatly changed the landscape. Second, the beacon was fully automated in 1987, which precipitated other changes to the fenestration of the tower and the connecting buildings. Last, a water pipe burst in the keeper's dwelling circa 1992, prompting the replacement of most first-story building fabric and all windows.

Although these modifications have altered the site throughout its existence, it has retained a great deal of its historical integrity. Its use has not changed, and its two most important structures remain intact.

Recap of Structure Lifespans at Highland Light Station

BUILDING↓ Docu. Date→	1855	1885	1903	1932	1944	1958	1966	1977	1994
Lighthouse	1857	X	X	X	X	X	X	X	X
Keeper's Dwelling	1856	X	X	X	X	X	X	X	X
Asst. Keeper's Dwelling	1857	X	X	X	X	X	1961R		
Brick Passageways-KD -AKD	? ?	X X	X X	X X	X X	X X	X 1961R	X	X
Wood Houses (3)	1873?	X	X	?					
Barn	1797?	R by 1885							
Hen Houses	X	X	?						
Fog Signal	1873	X	X	X	X	X	X	1977R	
Engine/Coal House	1873	X	X	1908R					
Barn/converted to Garage		by 1885	X	X	X	1956R			
Brick Oil House/Paint Locker			1900	X	X	X	X	1977R	
Merchant Marine Telegraph		X	X	X	?				
Radio Beacon				1932	X	X	X	X	1992R
Pump House					1937	X	X	?	
Pilot Balloon Observatory					1944	X	1960R		
Lookout Tower						1945	1966R		
Radio Dir. Finder Bldg.					?	1957R			
Duplex							1963	X	X

X = structure documented at that date, either through photographs or archival references
R = date building was razed

II. PHYSICAL DESCRIPTION

EXISTING EXTERIOR APPEARANCE

A week-long site visit was conducted during the last week of March 1994. Two architectural conservators and an historical architect measured, photographed, and noted all existing conditions. A ladder was provided by the Cape Cod National Seashore to allow thorough investigation of the roof systems and materials.

For the interior description, the rooms in each building have been assigned numbers. These numbers are B01-108 and 201-205 for the Keeper's Dwelling. Room titles are also provided for ease of reference.

For the exterior descriptions, some liberty has been taken to simplify the directional names of the structures' elevations. For example, the "north elevation" is actually oriented north-northwest.

[Note: in this section, the terms Keeper's Dwelling, Connector at the Keeper's Dwelling, Tower Connector, and Tower have been given initial capitalization, to highlight their individuality.]

Keeper's Dwelling

The Keeper's Dwelling consists of two sections: the main house, and an extension projecting from the east half of the north elevation. The main house contains the majority of rooms; the extension, or ell, has a large wraparound porch and contains the kitchen and an upstairs bedroom. Measurements of both portions are provided on plans and elevations included in appendix A.

West Elevation

This elevation is depicted in figure 37.

Main House

The west elevation of the main house, like that of the ell, is clad with unfinished wood shingles. These have an exposure of approximately 5 inches, and are trimmed with plain boards painted white. The foundation is of brick. The exposed part of the foundation varies between eight and nine courses of brick in height, and is painted white. There are two window openings in the foundation. Both have wood frames painted dark green. One opening has been blocked with a wood panel from the inside. The other contains a three-light sash. The trim of the latter is original to the 1856 construction period. A hose bib is located near the top of the foundation level between the two window openings. Approximately two courses above the foundation level at the center of the elevation is a small aluminum hood. It was probably for utility service.

At the south end of the west elevation is a covered entry protecting the main doorway (fig. 38). The covered entry is approximately 3 feet 6 inches deep and 6 feet 10 inches high, with a gable roof. The exterior walls are shingled, with a course exposure averaging 5 inches. The trim is plain and painted white. A piece of plywood has been placed on the south side, at the base of the covered entry. (It is wedged underneath the first few courses of shingles.) Its purpose is undetermined. However, it appears that the shingles at this corner have been chewed by the present owner's dog; the plywood may be acting as a barrier to prevent further damage. The roof of the entry is covered with wood shingles that match the coursing of the house's wall shingles.

Three risers ascend to the floor of the covered entry. The treads and risers of the steps are built of pressure-treated lumber. The floor of the covered entry is composed of 3-inch-wide boards running east-west. The interior walls of the covered entry are plywood painted white.

A white aluminum storm door covers the main doorway. The storm door is divided vertically into three sections; the top two sections are acrylic plastic. The main door is wood with three horizontal, recessed panels below six lights of glass.

There is one window opening at first-story level. It contains a double-hung, one-over-one vinyl window with plain wood trim painted white. It has a white aluminum storm window. A metal outdoor light fixture with three sockets is located near the north corner of the west elevation.

A gabled dormer is cut into the roof line approximately centered over the first-story window opening. The dormer contains one window opening. The opening holds a double-hung, one-over-one vinyl replacement window with plain wood trim painted white, and having a white aluminum storm window. The dormer is sheathed in unfinished wood shingles, with plain white trim boards on the sides and double-layered wood trim at the roof pitch.

A plain wooden cornice board at the top of the wall is painted white. Sections of wooden gutter, also painted white, run the length of the roof on either side of the dormer. The south section has two drain holes, one at either end. The south hole retains its outlet pipe, elbow, and downspout down to grade. The north hole has lost its pipe, leader, and downspout. The north section of gutter has one drain hole, just north of the dormer. It retains its outlet pipe and elbow, but lacks its downspout. The elbows and downspout are of corrugated, rectangular, unpainted aluminum.

The roof is covered with red asphalt shingles. A PVC vent pipe protrudes from the roof near the north end. A brick chimney at the center of the ridge line (fig. 39) has been painted white. On the chimney the date 1857 is painted in black letters. The top three courses are corbeled. The top five courses are painted black. The chimney is flashed on three sides with metal flashing; the west side is covered with a troweled material. The flashing has been painted to match the color of the roofing.

Ell

The west wall of the ell of the Keeper's Dwelling (fig. 40) is set back 12 feet from the west wall of the main house. An open, one-story porch extends along the entire west wall of the ell and along much of the north wall, where it ends at an enclosed area (the north vestibule). This porch and vestibule will be discussed shortly. The west wall of the ell is covered with unfinished wood shingles with plain white-painted trim boards. It has two window openings; each contains double-hung, one-over-one sashes with a white aluminum storm sash over them. Plain white trim boards surround each window opening.

There is one dormer window on the west roof slope of the ell; it extends down through the eaves line. The sides of the dormer are wood-shingled and trimmed out with plain boards painted white. The roof of the dormer is a gable roof. The window contains double-hung, one-over-one sashes with aluminum storm sash.

The height of the ell roof at the ridge is about 8 feet above the porch roof. The roof of the ell and its dormer are covered with red asphalt shingles and trimmed in plain white boards. A wood gutter, also painted white, extends along both eaves. A brick chimney, once whitewashed, is located on the ridge at the north end of the ell roof. Its top six courses are painted black. The top three courses are corbeled and there is an opening under the chimney cap that is oriented east to west. Step flashing at the chimney has been painted red to match the color of the asphalt roof.

The wraparound porch is seen in photographs as early as 1903, but was altered in the 1930's. It is supported by wood foundation posts. These posts are spaced unevenly, ranging from 7 feet 1 1/2 inches to 7 feet 11 inches on center at the northeast corner. Sections of pressure-treated, unpainted wood lattice run between the posts to screen the area under the porch. The northwest corner of the porch rests on a concrete-block pier. This appears to have been added as reinforcement for this corner, where four steps of pressure-treated wood descend to grade.

The floor of the porch consists of boards 3 3/4 inches wide that run east-west on the west section of the porch and north-south on the north side of the porch. The boards are mitered at the northwest corner.

The perimeter of the porch is enclosed by a half-wall approximately 2 1/2 feet high and capped by a flat board 10 1/2 inches wide and painted white. The wall's corner boards are unpainted. Four columns and two pilasters—one at each end of the porch—rest on the half-wall and support the roof above. These are spaced approximately 7 feet apart. They are painted white and taper from the base to the neck. Their bases are 10 inches square (See figure 41.)

The west exterior wall of the north vestibule (fig. 42) is covered with vertical beaded boards 6 inches wide and painted white. It contains a doorway leading into the interior of the vestibule. The main door here is wood, six-paneled, and painted white; it is covered by an aluminum storm door. A paint ghost around the doorway frame suggests that its trim is a replacement.

The ceiling of the porch, probably a 1950's replacement, is covered with large plywood panels with battens, all painted white. A ceiling light fixture made of metal and glass is located at the north end of the porch.

The hipped roof of the porch is covered with red asphalt shingles. A plain cornice board with wooden gutter, both painted white, extends along the porch roof line.



Figure 37. Keeper's Dwelling, west elevation.



Figure 38. Keeper's Dwelling, covered entry at south end of west wall.

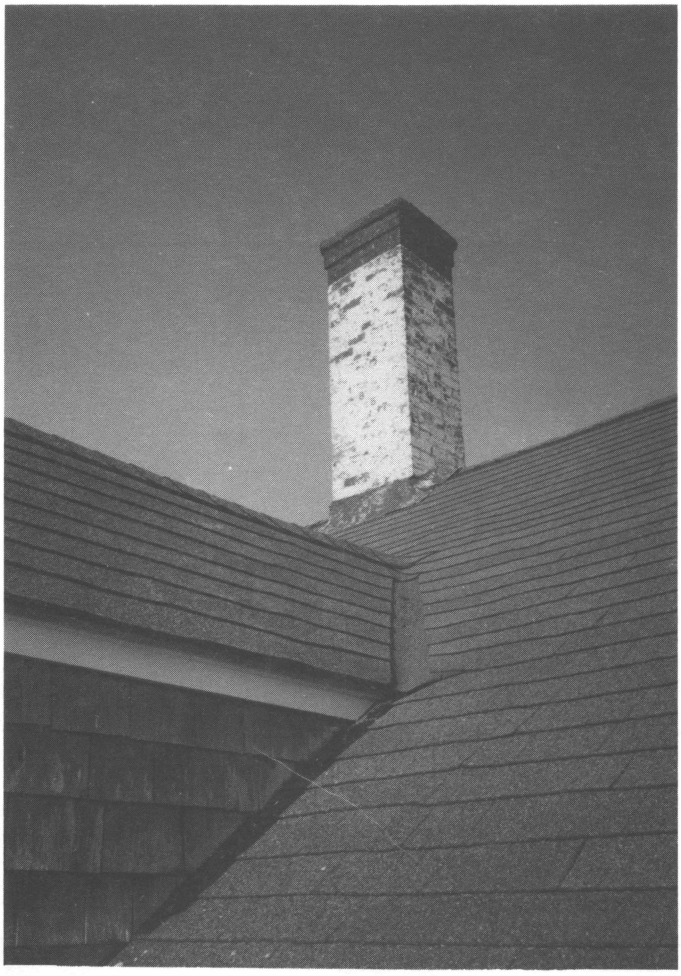


Figure 39. Keeper's Dwelling, brick chimney with date of 1857.



Figure 40. Wraparound porch on Keeper's Dwelling ell.

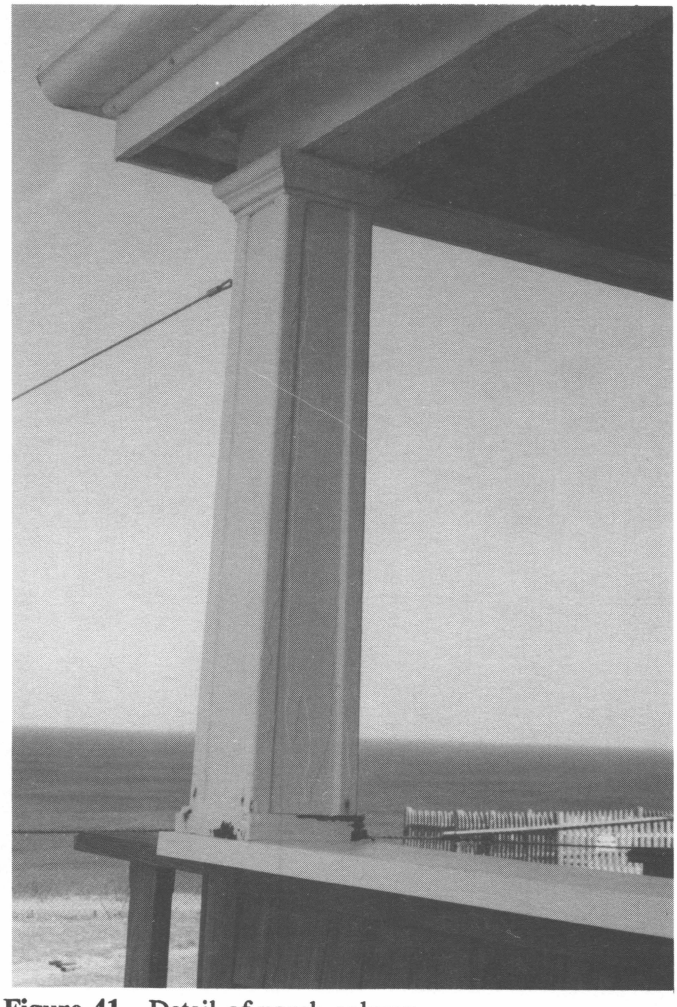


Figure 41. Detail of porch column.

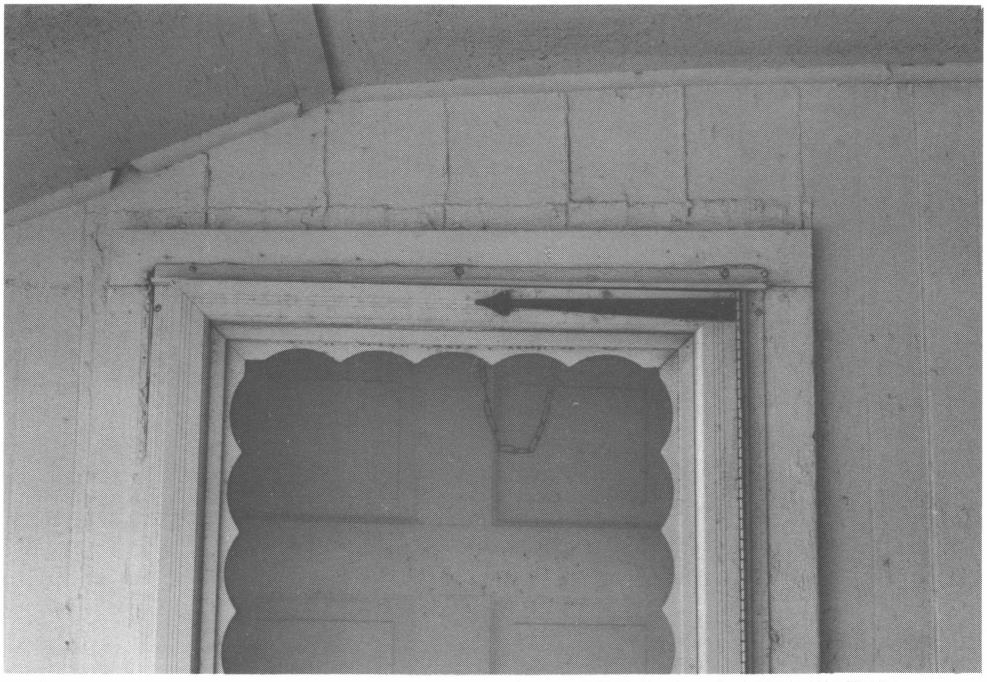


Figure 42. Keeper's Dwelling ell, west exterior elevation of north vestibule.

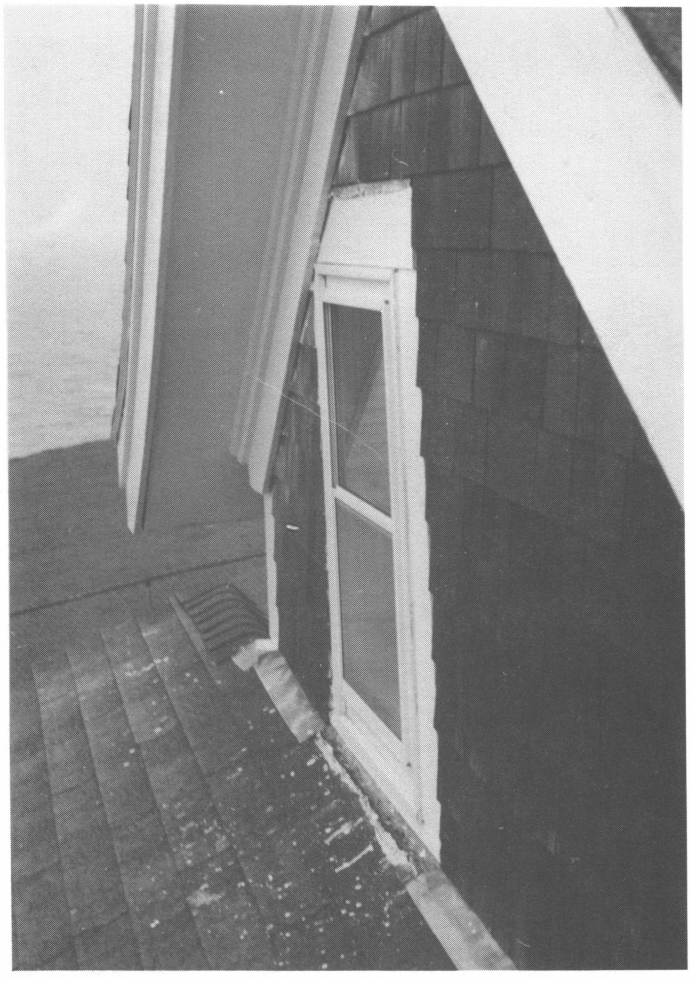


Figure 43. Keeper's Dwelling, second story of north elevation.

North Elevation

Main House

The previously mentioned ell covers most of the east half of the north wall of the main house. The west half of this wall is clad with unfinished wood shingles. These have an exposure of approximately 5 inches, and are trimmed with plain boards painted white. The foundation is of white-painted brick. There is a single window at second-story level. It contains double-hung, one-over-one sashes and an aluminum storm sash. The raking end of the roof has an overhang of about 12 inches, and is trimmed with two plain, overlapped boards painted white.

Ell

The wraparound porch covers much of the north wall of the ell (approximately 15 feet). The rest of the wall is covered by the north vestibule, which juts out past the ell. The ell's north foundation is made of 12 courses of brick that have been whitewashed or painted white. There is a three-light sash in a window opening near the northwest corner.

The first-story wall within the porch is clad with unfinished wood shingles with plain white-painted trim boards. The same is true of the first-story wall of the vestibule, and the second-story wall above the porch and vestibule. Located at the northeast corner of the vestibule wall, just below the porch roof line, is a bracket that once held a now-missing gutter.

The floor of the north section of the porch consists of boards 3 3/4 inches wide that run north-south. The boards are mitered at the northwest corner, where they meet the east-west boards of the west section of the porch.

A window with double-hung, one-over-one sashes and an aluminum storm sash is located at second-story level, toward the east end of the wall. The raking end of the ell roof (fig. 43) has an overhang of about 12 inches here, and is trimmed with two plain, overlapped boards painted white.

East Elevation

Main House

Most of the east foundation wall is covered by soil that has accumulated in front of it. (The area around the basement window opening, near the midpoint of the wall, has apparently been kept clear.) The window opening has a three-light sash. An electrical junction box is located above this window on the shingled section. The electrical conduit rises out of the ground to the south of the window opening and a hose bib is adjacent to the junction box.

The east elevation above foundation level (fig. 44) is clad with unpainted wood shingles and trimmed with plain corner boards painted white. There are three windows at the first-story level. They are trimmed in the usual way, and contain double-hung, one-over-one sashes with storm sashes.

Two dormer windows are located in the east roof slope of the main house, above the two northern first-story windows. They do not break the eaves line, but extend upward. Oddly enough, each has its own gable roof, whose peaks are of unequal height (the roof of the south dormer is slightly lower). Both dormers are clad with unpainted wood shingles and trimmed with plain white-painted corner boards. The raking ends of their roofs are finished with two plain, overlapped boards painted white. The window openings in the dormers contain one-over-one double-hung sash with white aluminum storm sash.

The roof overhang is approximately 18 inches. A plain cornice board with wood gutter runs the length of the roof on either side of the dormers. A metal elbow without a downspout is located south of the dormers. A broken bracket for the missing downspout exists five shingle courses below the end of the elbow.

The east roof slope of the main house and its dormer roof are covered with red asphalt shingles.

Ell

While some soil has accumulated up against the south end of the ell's east foundation wall, most of the white-painted brick foundation here is exposed. The east wall of the ell is flush with the east wall of the main house, and is sided identically to it. Located where these two walls intersect is a window opening that contains a single-light, casement sash with an aluminum storm window. It is trimmed with plain white-painted boards.

At the north end of the ell's east wall, the north vestibule (fig. 45) projects eastward. The foundation of the vestibule consists of wood posts covered with pressure-treated lattice panels. The walls of the vestibule are shingled and trimmed with plain, white-painted corner boards. There is a doorway in the south wall of the vestibule. It is accessed by three green-painted concrete steps with a pipe railing. A brass or bronze disk is embedded into the east corner of the bottom step (fig. 46). It is embossed with a date and the words: "U.S.COAST & GEODETIC SURVEY BENCH MARK - FOR INFORMATION WRITE TO THE DIRECTOR, WASHINGTON, D.C.- $250 FINE OR IMPRISONMENT FOR DISTURBING THIS MARK- TB M-NO16-RESET 1958." The doorway (fig. 47) is covered by a white aluminum storm door. The main six-panel door is of wood painted an off-white color. The gable roof of the vestibule is asymmetrical: the short south slope projects to protect the south doorway, while the long north slope covers the remainder of the vestibule. The east gable end has typical white-painted rake trim. The soffit of the south roof slope is a white-painted plywood panel that covers three rafters that extend from the entry ridge. The plywood is cut around the rafter ends.



Figure 44. Keeper's Dwelling, east elevation.



Figure 45. Keeper's Dwelling ell, east exterior elevation of north vestibule.



Figure 46. Keeper's Dwelling ell, north vestibule, concrete steps with embedded disk.

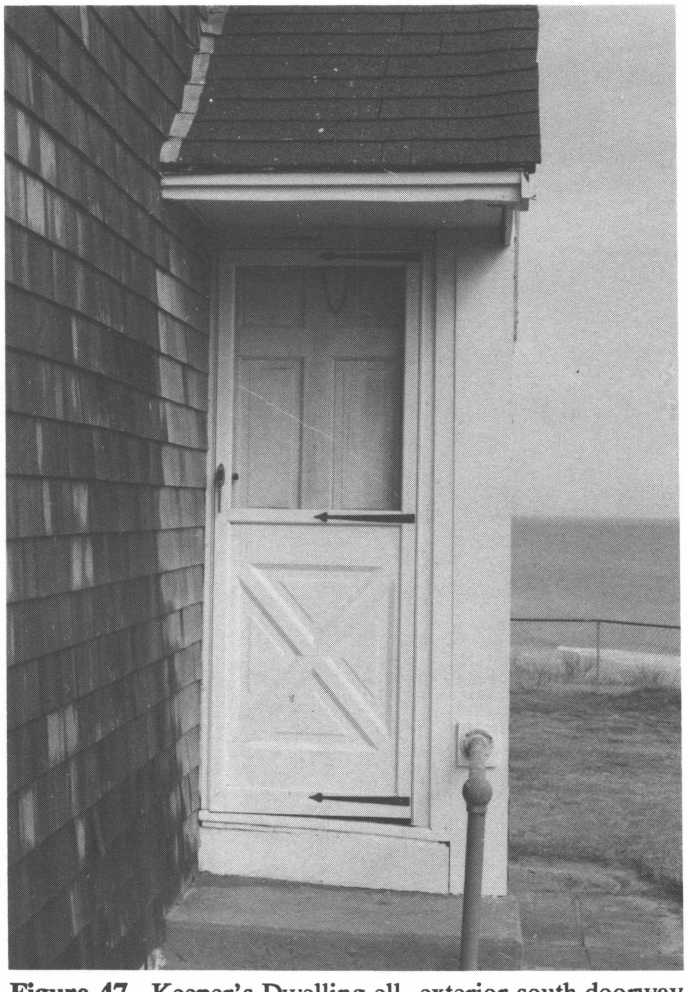


Figure 47. Keeper's Dwelling ell, exterior south doorway of north vestibule.

South Elevation

Main House

The south elevation of the main house (fig. 48) abuts the Connector at the Keeper's Dwelling. The foundation is of white-painted brick. A bulkhead with red metal doors is located near the center of the exposed foundation wall. The bulkhead leads to the basement of the Keeper's Dwelling. An electrical meter, water pipe, and metal bracket are at the base of the south elevation, near the west end.

The wall above foundation level is clad with unfinished wood shingles with the usual plain white corner boards. There is one first-story window opening, near the west end of the wall. It has double-hung, one-over-one sashes with a white aluminum storm sash. Two evenly-spaced one-over-one double-hung windows, also with white aluminum storm sash, are located on the second floor.

The raking end of the gable roof is trimmed with the usual overlapped white-painted boards. The upper board flares slightly to piece around the gutter ends. The roof overhang is 18 inches.

One bracket for a downspout remains on this elevation, indicating that a gutter extended along the cornice of the adjacent Keeper's Connector (fig. 49).

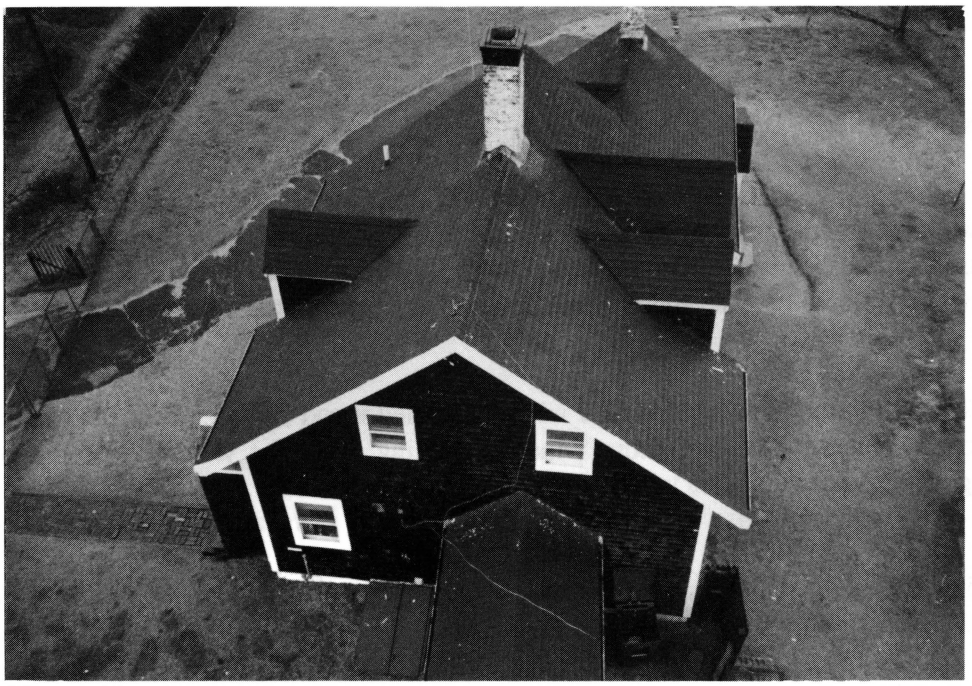


Figure 48. Keeper's Dwelling, south elevation, seen from Tower.



Figure 49. Keeper's Dwelling, south elevation, bracket for missing downspout.

Connector at the Keeper's Dwelling

The Connector at the Keeper's Dwelling is a simple rectangular brick building, whose north side is attached to the Keeper's Dwelling, and whose south side is attached to the Tower Connector. (See the interior description of Rooms 107-111). The angle of the Connector relative to the Keeper's Dwelling is 5 degrees towards the east (see app. A). It sits lower than the Keeper's Dwelling by approximately 10 inches. The size of its bricks is 7 1/2 by 2 1/4 inches. Only the 17th course of brick was laid as all headers. The bricks have been painted with a thick coat of cementitious wash. This coating was applied with a type of stiff bristle brush: horizonal brush marks are visible on the brickwork (fig. 50).

The building has no remaining usable exterior entries. Two segmentally arched doorway openings, one at the south end of the west wall and one in the middle of the east wall, have been closed with white-painted plywood on the interior side. The east doorway is inset into the wall. It has a concrete threshold, also painted white. There is one window, in the middle of the west elevation (fig. 51). It is set into a segmentally arched opening in the brick wall, and contains double-hung, six-over-six wood sashes with an aluminum storm sash.

At the top of both east and west walls is a plain cornice board below the overhanging eave. Both cornice and eave are painted white. The built-in wood gutters on the east and west elevations are also painted white. The west and east elevations each had two downspouts, one at either end of the wall. The west elevation's south downspout is attached to the north wall of the Tower Connector (fig. 52). The other three downspouts are missing, but their outlet tubes remain. Step flashing at the joint between the Connector at the Keeper's Dwelling and the Tower Connector to its south is painted white. The roof is covered with red asphalt shingles.



Figure 50. Connector at the Keeper's Dwelling, brick sizes and brush marks on east elevation.

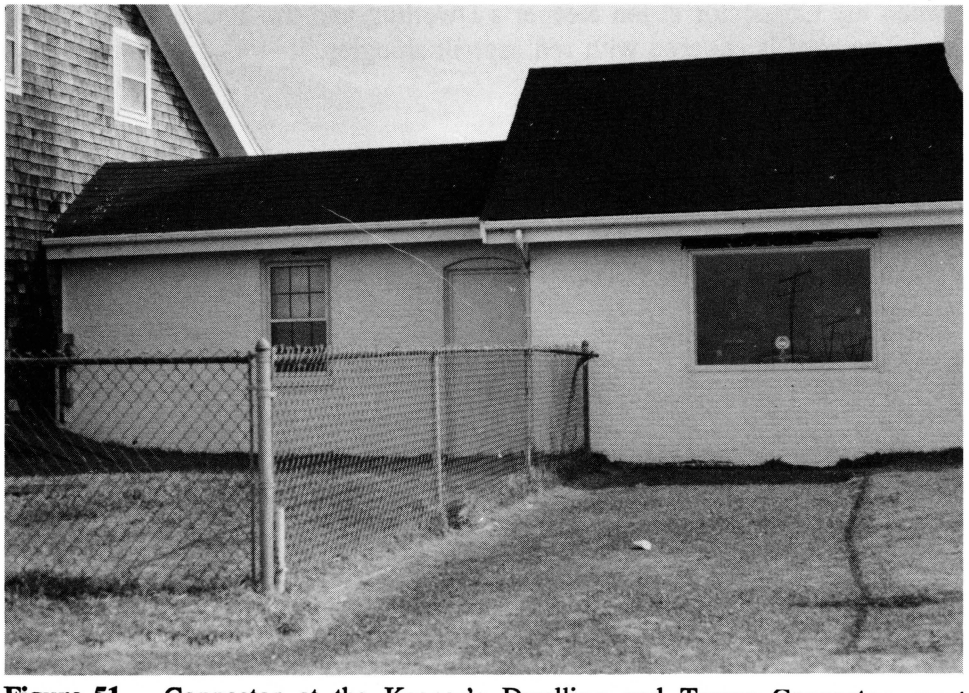


Figure 51. Connector at the Keeper's Dwelling and Tower Connector, west elevation.



Figure 52. Connector at the Keeper's Dwelling and Tower Connector, west elevation: blocked entryway, outlet tubes, and downspouts.

Tower Connector

The Tower Connector is a rectangular brick building slightly larger and taller than the Connector at the Keeper's Dwelling, which it abuts on its north side. Its south side connects with the Tower. The bricks of the Tower Connector measure 7 1/2 by 2 1/4 inches, and are painted white. An electric meter is located at the north elevation of the Tower Connector on the west side.

There is one doorway, on the east wall where the Tower Connector abuts the Connector at the Keeper's Dwelling. It is protected by a concrete-block entry (fig. 53). Above the doorway is a triangular pediment covered in weathered wood shingles and trimmed with plain boards painted white. A single-bulb metal outdoor light fixture is located above the door. The doorway opening contains a steel door that leads into the tower entry (Room 109). The concrete step at the exterior of the entry was installed in 1900. The east wall also has a segmentally arched window opening that was filled in with brick in 1987 (fig. 54). This infill is recessed 4 inches from the plane of the wall; its bricks are also painted white, but are of a larger size than the wall bricks. On the west elevation of the Tower Connector, an original window opening was enlarged and a single plate glass window was inserted in 1987 (fig. 55).

The plain cornice, eave overhangs, and gutters are of white-painted wood. Sections of wood trim have been attached to the overhang of both the Connector at the Keeper's Dwelling and the Tower Connector to meet the cornice boards of the entry. The west elevation had two downspouts, one at either end of the wall. Only the one at the north end remains, but the south one retains its outlet pipe. The east elevation had one downspout, at its south end. This has disappeared, but its outlet pipe and elbow remain.

The roof of the Tower Connector is covered in red three-tab asphalt shingles. The north end of the roof overhangs the lower roof of the Connector at the Keeper's Dwelling. Its raking eaves are trimmed with the usual plain white overlapped boards. The lower rake board has a series of eye screws in it. They begin just above the ridge of the Keeper's Connector roof line; their function is undetermined. The east-side raking eave intersects the roof ridge of the concrete-block entry. The north slope of the entry roof extends under the rake to abut the face of the north wall (fig. 56).

The south end of the Tower Connector roof curves to follow the Tower. The step flashing here is painted white.



Figure 53. Concrete-block entry at junction of Connector at Keeper's Dwelling and Tower Connector, east elevation.



Figure 54. Tower Connector, blocked window on east elevation. Note larger brick size.



Figure 55. Tower Connector, west elevation.



Figure 56. Tower Connector, roof overhang at junction with Connector at Keeper's Dwelling.

Tower

The Tower is located at the south end of the Tower Connector (fig. 57). It is 66 feet high to the top of the lantern house vent ball, excluding the spike. The Tower consists of three sections: the long, tapering, cylindrical shaft; the straight-sided Watch Deck and Watch Gallery; and the straight-sided Lantern and Lantern Gallery.

Shaft

Walls

The main shaft is of brickwork painted white. Its walls are approximately 3 feet 7 inches thick at the base and approximately 2 feet 2 inches thick where it meets the Watch Gallery. The brick size is 7 1/2 by 2 1/4 inches, which matches the brick size of the two connecting buildings. Two lightning-rod grounding cables, both painted white, run down the east and west sides.

Window Openings

The south elevation of the shaft has two window openings located approximately 10 brick courses above grade. They measure 3 feet wide by 4 feet high (fig. 58). Each has a granite sill and lintel, both painted white. Cement parging on the top exposed surface of the sills slopes to the exterior. Both window openings are filled with 6-inch square glass blocks in panels four units wide by six units high. Gray mortar fills the joints between the glass blocks. In the second row of glass blocks, vents replace the two center blocks. These vents are made of unpainted metal and are fixed in place by screws on the exterior. There is a third window on the northwest elevation of the shaft (fig. 60), immediately below the Watch Gallery (at the level of the interior Weight Deck). The size of the opening and glass-block panel is similar to those of the south-elevation windows.

Watch Deck and Gallery

Walls

The exterior wall of the Watch Deck is 7 feet 1 1/4 inches high. It is also of white-painted brick. It is surrounded by the Watch Gallery, which is the lower of two observation decks (fig. 61).

Floor

The floor of the Watch Gallery is composed of 15 granite blocks, with a curved underside that is painted black. The length of each block is approximately 2 feet 6 inches, and the depth is 2 feet 6 inches. The top of the joints between the blocks are covered with a protective strip of sheet

metal. A 3-foot-high iron railing with balusters and square posts runs around the perimeter of the Watch Gallery. It is painted black. Eight tie rods connect the Watch Gallery to the Lantern Gallery above it. These were installed in 1868, and are today all painted black.

Doorways and Doors

A doorway on the north side of the Watch Deck wall leads to the interior of the Watch Deck. The doorway is arched, 2 feet wide, and 5 feet 9 inches high. The exterior door is of board-and batten-construction, the six vertical wood boards being secured by three horizontal battens. The door is painted white. There are two other doors inside this one; they will be discussed in the interior description. An iron ladder on the west side of the Watch Gallery leads to a narrow circular opening in the floor of the Lantern Gallery (fig. 63). The ladder is painted black. Immediately to the north of the ladder is a large support for a former signal staff, also painted black.

Lantern and Lantern Gallery

Walls

The walls of the Lantern consist of 16 window panels joined by vertical iron mullions painted black. The panels are 9 feet 11 1/2 inches high by just over 2 feet wide. Each panel is divided horizontally by other black-painted iron mullions into three sections. The lower sections are 2 feet 7 1/2 inches high. They consist of thin-gage aluminum sheet. Slotted sheet-metal covers at the base of these sections connect to interior vents. The middle sections are 3 feet 4 3/8 inches high, while the upper sections are a little less than 4 feet high. Both of these sections are of plexiglass set into the frame with sealant. Each upper horizontal mullion has a hand-hold cast into it (fig. 65), which is also painted black. Together, these hand-holds form a continuous inner handrail around the Lantern Gallery.

Floor

The floor of the Lantern Gallery is composed of four cast-iron sections that have been bolted in place, which are continuous with the floor at the interior. A slotted lip 5 inches high runs around the Lantern Gallery where a pipe railing has been installed (fig. 64). The entire assemblage is painted black. A radio or other antenna is attached to the railing on the south side of the gallery.

Doorways and Doors

The only access to the Lantern Gallery is the circular opening in the floor, with its ladder down to the Watch Gallery.

Roof

The cap of the Lantern consists of eight metal sections bolted together (fig. 66). The peak of the roof is capped by a slotted ventilator for the Lantern Deck. The lantern cap is painted black.



Figure 57. Highland Light Station, west elevation.

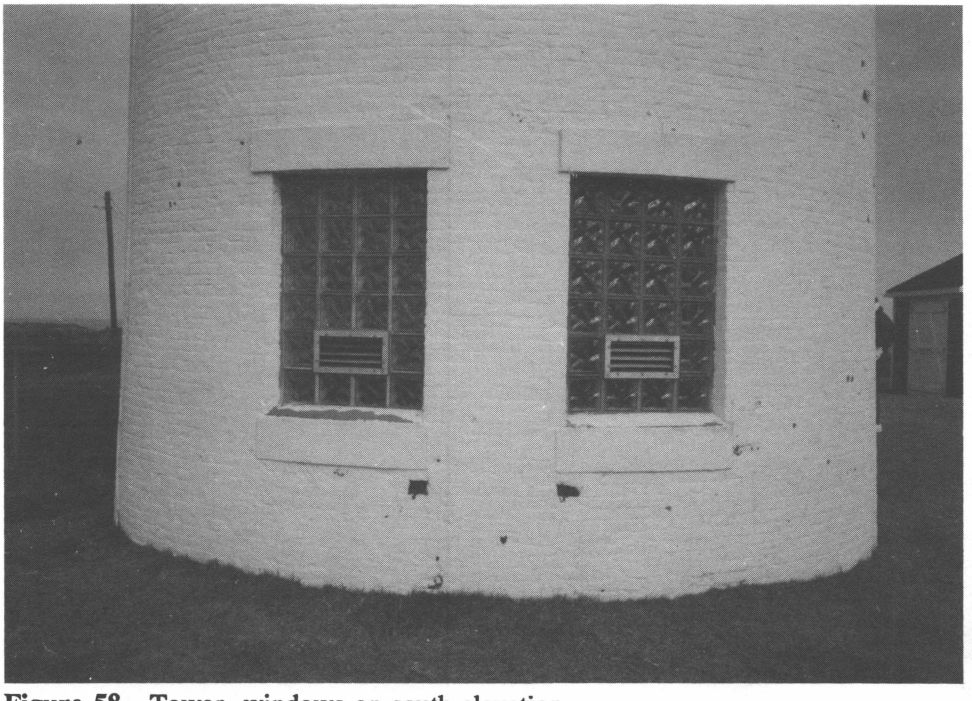


Figure 58. Tower, windows on south elevation.

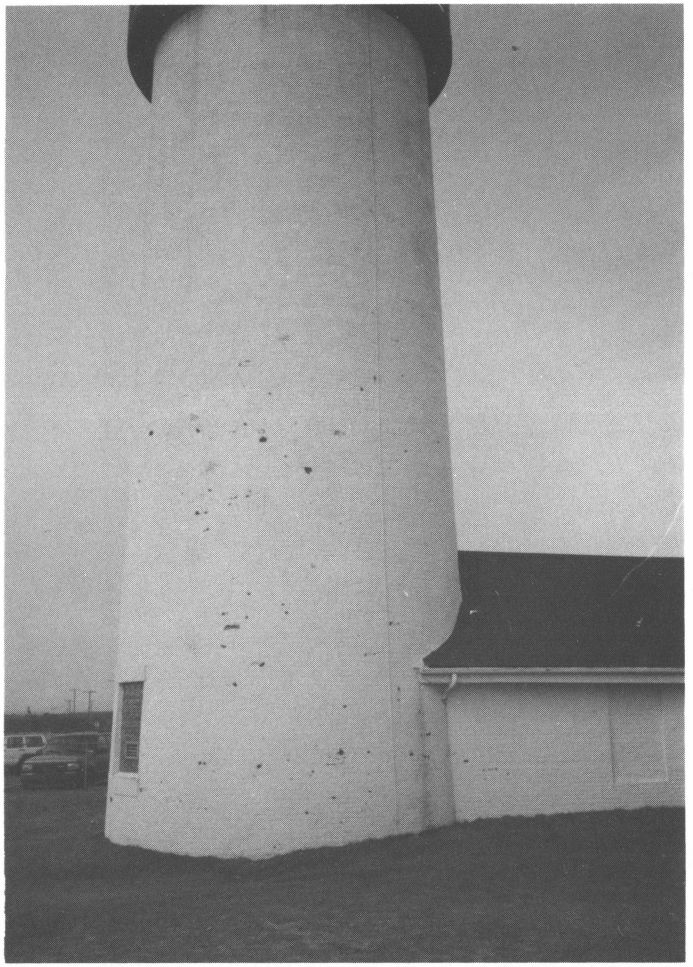


Figure 59. Tower, east elevation.

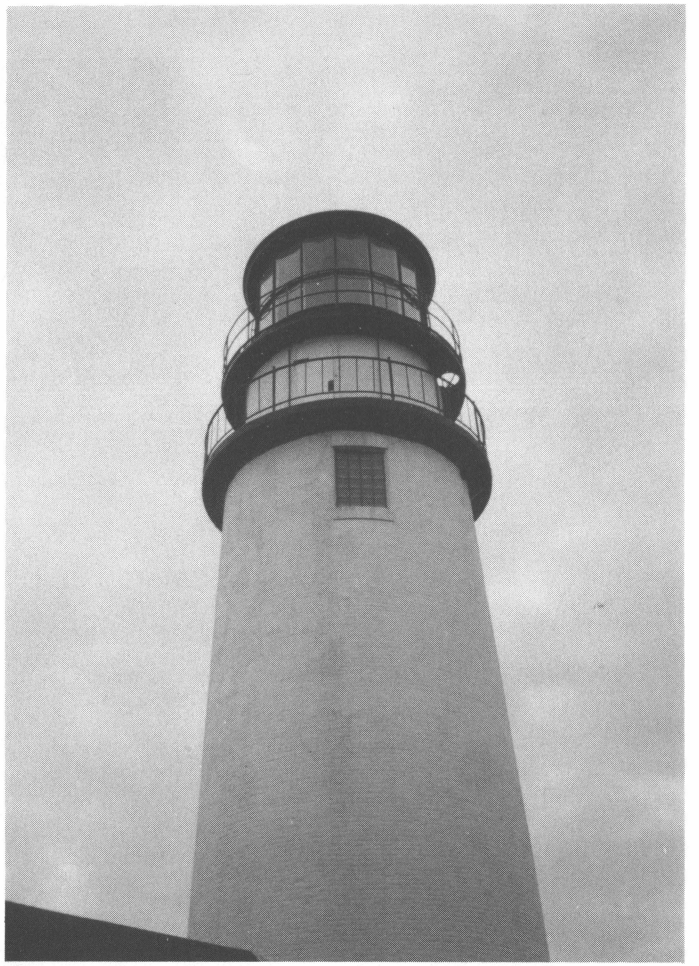


Figure 60. Tower, northwest elevation.



Figure 61. Tower, northwest elevation.



Figure 62. Tower, detail of joints in granite-block floor of Watch Gallery.



Figure 63. Tower at Watch Gallery: pipe support, tie rod, and underside of Lantern Gallery, showing ladder opening.



Figure 64. Tower, railing of Lantern Gallery.

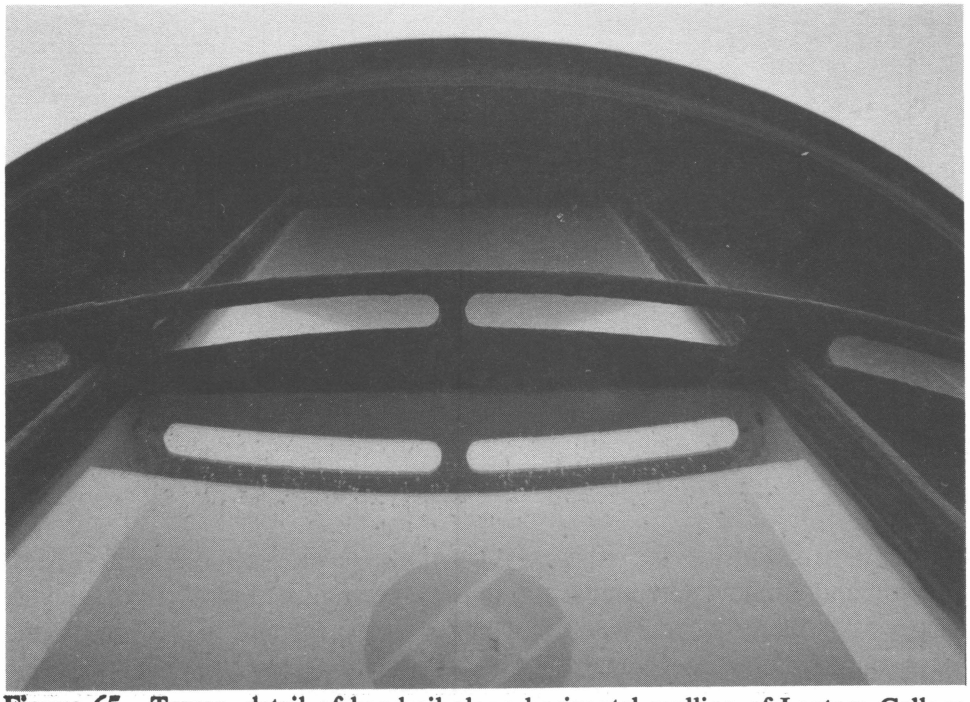


Figure 65. Tower, detail of handrail along horizontal mullion of Lantern Gallery window wall.

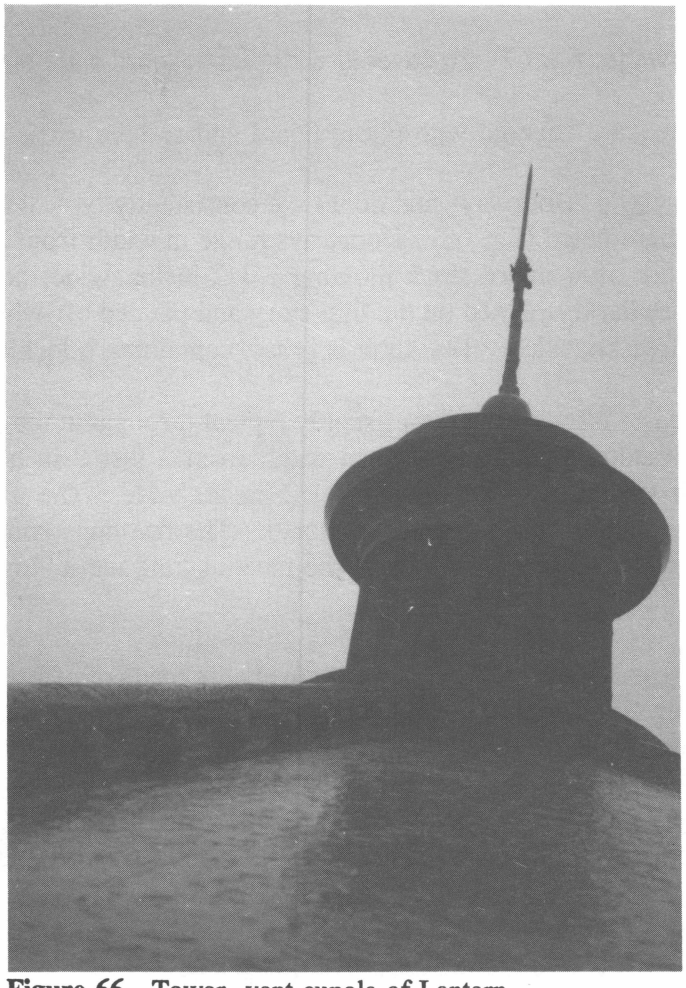


Figure 66. Tower, vent cupola of Lantern.

EXISTING INTERIOR APPEARANCE

Keeper's Dwelling

General Information

Many of the elements inside the Keeper's Dwelling have been replaced. Most baseboard moldings, doorway and window surrounds, and doors were replaced circa 1992 with standard stock molding. Features that were not replaced, or which are atypical, are highlighted in the description of each room. Where features are typical, they will be noted as such. Typical descriptions follow:

Common Features

Floors. Wall-to-wall beige-colored pile carpeting has been laid in all rooms except the kitchen, bathrooms, and northeast vestibule.

Walls. Interior walls (fig. 67) are covered with plasterboard and painted an off-white color.

Ceilings. Ceilings are covered with plasterboard and painted white (fig. 67).

Doors and Doorways. Doorways and doors are consistently typical throughout the first and second stories except where noted (fig. 68). Doorways range in width from 2 feet 6 inches to 2 feet 10 inches. Surrounds are of standard stock molding 2 1/2 inches wide; doors are wood with six recessed panels. Both are darkly stained on the first story and painted off-white on the second story. Hinges are brass and three-knuckled. The knob is brass, containing a locking mechanism.

Window Openings. Windows are consistently typical throughout the first and second stories except where noted. Window openings range in width from 2 feet 8 inches to 2 feet 10 inches. They are trimmed with standard stock molding 2 1/2 inches wide. The molding is either darkly stained (first story) or painted off-white (second story). The openings contain double-hung, one-over-one wood sashes with a center sash lock at the meeting rail and a single recessed pull in the lower sash.

Electrical Fixtures. Switch plates and outlet covers are made of off-white plastic that matches the wall color. Lighting fixtures differ from room to room except with respect to their location, which is generally at the center of the ceiling.

Heating Elements. Forced hot-water baseboard heating elements with metal white-painted covers (fig. 69) are identical throughout the house. This system was installed in 1957.



Figure 67. Room 105, showing typical walls, ceiling, and floor.

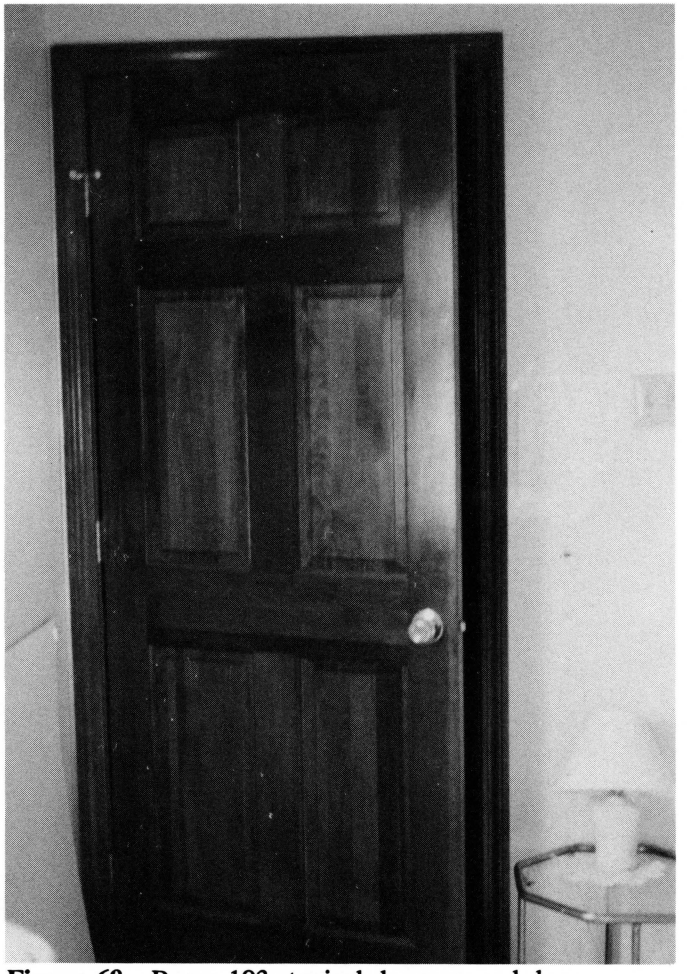


Figure 68. Room 103, typical doorway and door.



Figure 69. Room 102, typical baseboard heating unit.

Basement

Room B01

A full basement exists in the Keeper's Dwelling. It measures 21 feet 6 1/4 inches by 23 feet 8 1/4 inches. The area under the stair at the north wall is enclosed with screening for storage space. A brick cistern is adjacent to the screened space in the northeast corner. The brick size used in the cistern area is larger than either the bricks used for basement flooring or the bricks used for the foundation walls. In the cistern, the size of the bricks on the east wall is 7 3/4 inches by 4 inches; on the north wall it is 7 inches by 4 inches. A 5-foot-high brick wall forms the perimeter of the cistern on its south and west sides. Here the brick size is 8 1/4 inches by 2 1/2 inches. This south wall has had an opening cut through it. Because the bricks are broken off at their ends, the opening was created after the wall was built and the cistern was no longer used (fig. 70). A brick step, four courses high, was created leading into the cistern when the wall section was removed.

Wooden steps painted gray lead from the basement of the Keeper's Dwelling to the first story along the north wall near the west corner. There are nine treads and eight risers. Treads measure 8 1/2 inches, risers measure 10 inches.

Wire-mesh screen with gray-painted wood frame and supports was used to construct an enclosure with shelves underneath the stairs. A door into the storage area beneath the stairs at the northwest corner of the room is made of wire mesh framed with wood. It is painted gray.

A brick chimney is located at the center of the house. It is painted white and vents the oil-fired burner. At the chimney base is a small iron door used for ash removal.

Floor. The basement floor is red-painted concrete. The concrete was poured over brick, which is exposed at the south wall near the east corner (fig. 71). In several places, level concrete pads have been poured that raise the floor level at their respective locations between 1 and 4 inches. These were probably for mounting station generators or emergency power generators, since it was typical in lighthouses to mount all generators on concrete pads.[1] A drain hole with a square metal cover is located near the center of the floor.

Walls. The walls are brick. The brick is painted white. Several patches exist along the east and south walls. Patches are evident because they are filled with larger-sized bricks.

Ceiling. Exposed wood subflooring and exposed joists compose the ceiling. These are painted white. Metal and PVC piping runs in both directions between and under joists for hot-water heating and domestic plumbing.

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[1]Entry in transmittal letter of HSR draft comments, Lieutenant-Commander D.R. May to Myra F. Harrison, June 20, 1994.

Doorways and Doors. A doorway leading into the bulkhead is located to the north of center of the south wall (fig. 72). It is fitted into the foundation wall, off the floor 11 1/2 inches. The door is composed of vertical beaded boards that are approximately 6 inches wide. Paint ghosts are visible where old strap hinges had been located. A black, rounded metal handle with latch is located in the center of the door. Two new unpainted metal hinges now secure the door. Battens form the pattern of a backwards Z on the door, with an additional half-batten near the mid-section. The door is painted gray.

Window Openings. There are two window openings containing wood window sashes on the west wall. The sashes each have three lights. The north opening is blocked with plywood. A third window is in the east wall. It, too, contains a three-light sash and had been blocked with plywood.

Electrical Fixtures. Five single-bulb, white porcelain fixtures with pull strings are attached to joists, to provide overhead light in the basement.

Heating and Plumbing Elements. There is an oil tank, a hot-water heater, and an oil-fired boiler in the basement. A large industrial basin sits at the northeast corner of the room adjacent to the cistern wall.

Other. Red-painted concrete steps with seven risers exit the building through the metal double bulkhead doors that swing outward. The side walls are of brick painted red. The opening for the bulkhead is 2 feet 11 3/4 inches wide by 5 feet 7 inches deep in plan.



Figure 70. Room B01, cistern area at northeast corner.



Figure 71. Room B01: floor bricks and raised concrete pads.



Figure 72. Room B01, doorway to bulkhead on south wall.

First Story

Room 101 - Northeast Vestibule

The room is located off the northeast corner of the kitchen. It extends further north and east than any other enclosed part of the building. The room dimensions are 7 feet by 6 feet 8 inches.

Floor. The floor is covered with broken vinyl tile, painted green.

Walls. These are typical. There is a plain 3-inch baseboard around the walls, which are painted off-white.

Doorways and Doors. Three typical off-white-painted doorways are located in this room. Two are on the south wall, one leading out to the concrete stairs on the exterior and one into the kitchen. Access to the outside porch is gained through a typical doorway on the west wall. Molding around the doorways is typical.

Window Openings. None.

Electrical Fixtures. There is a single-bulb white porcelain fixture on the ceiling at the center of the room.

Heating Elements. None.

Room 102 - Kitchen

The kitchen is located in the ell. Its dimensions are 15 feet by 12 feet 2 1/2 inches. It was completely renovated circa 1992.

Floor. The floor is covered with one-foot-square vinyl composition tiles (VCT). The pattern consists of a beige background with dark brown, gray, and black flecks.

Walls. Typical, except they have a wooden chair rail. The chair rail is 2 3/4 inches high with a cap, and is darkly stained. Standard kitchen cabinets, a sink, and a stove line the east wall.

Ceiling. A single encased beam runs east to west near the doorway to the southeast room (fig. 73). It is darkly stained and does not appear to be original. The ceiling is otherwise typical.

Doorways and Doors. A typical doorway to the southeast room (Room 103) is located on the south wall. A double louvered door to a closet (fig. 74) is located at the northwest corner of the room. It is 2 feet wide with plain wood below louvers. The trim is typical. A door in the northeast corner of the room leads to the north vestibule (Room 101). The doorway and door are typical.

Window Openings. There are two windows in the west wall and one in the east wall. They are typical.

Electrical Fixtures. There is a double-switch plate near the northeast corner on the east wall. There is also a single switch plate on the south wall. The kitchen has an overhead fixture. It is a glass half-globe with a single bulb.

Heating Elements. A typical element exists on the west wall.

Other. The pantry closet (Room 102a), behind the louvered doors in the northwest corner of the kitchen, has all typical fabric. There is no baseboard or chair rail. Unpainted wood shelves are attached to the east wall.

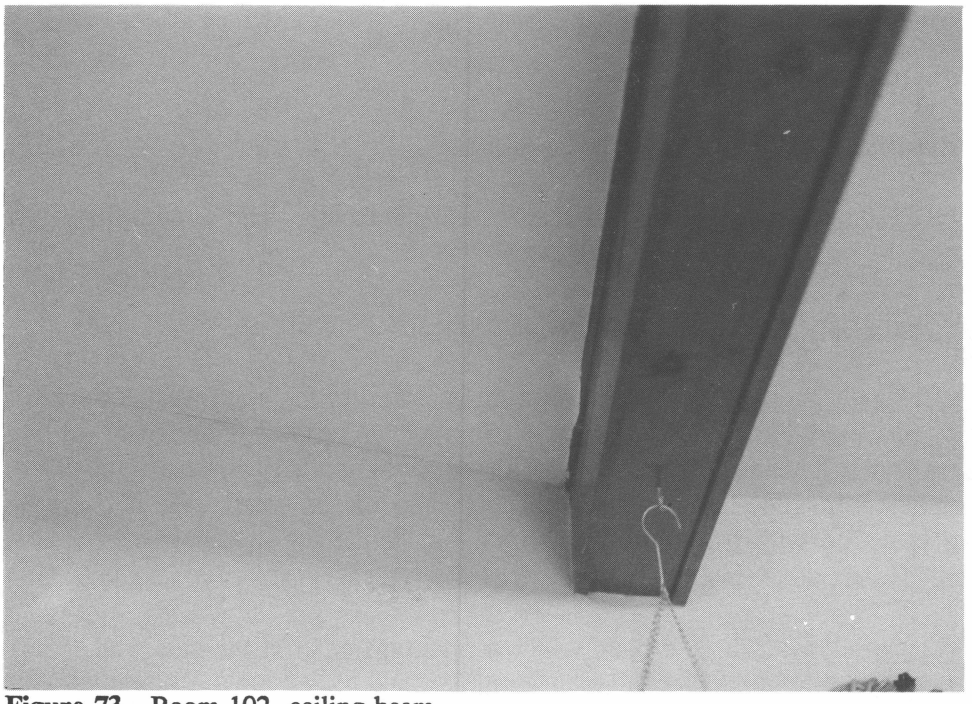


Figure 73. Room 102, ceiling beam.



Figure 74. Room 102, louvered doors to pantry closet (Room 102a).

Room 103 - Southeast Room

Room 103 has been stripped of most of its earlier fabric. The dimensions of the room are 12 by 20 feet.

Floor, Walls, and Ceiling. These are all typical.

Doorways and Doors. The southeast room is joined to the southwest room (Room 105) by a doorway in the west wall. The doorway is trimmed typically. A doorway on the north wall provides access to the Kitchen (Room 102). This doorway is also trimmed typically. A doorway to the stair hall (Room 104) is located at the north end of the west wall; it has a typical door. Finally, there is a doorway from this room into the Connector at the Keeper's Dwelling. The doorway is only 2 feet wide, but its trim and door are typical.

Window Openings. Three typical window openings exist in the east wall.

Electrical Fixtures. There is an overhead glass globe with single bulb in the center of the ceiling. Wall switches are located on the south, west, and north walls. These are typical.

Heating Elements. There is a thermostatic control dial on the west wall. A baseboard heating element is located on the east wall.

Room 104 - Stair Hall

The stair hall contains some circa-1900 fabric, including the stair stringer, trim, and baseboards. The room dimensions are 6 feet 3 inches by 9 feet 4 inches. The door to the basement is located in the northwest corner of the room. The stairway is U-shaped with winders. It consists of 12 risers approximately 9 inches high and 11 treads that vary between 10 and 10 1/2 inches deep.

Floor. This is typical.

Walls. The walls are typical. A plain baseboard painted an off-white color exists along the west wall between the basement doorway and the stairway. Paint ghosts (fig. 75) on the top section of baseboard suggest that this fabric was not replaced during the renovation, but that a molded cap was removed. The stringers on either side of the stairway are also plain. They are the same height as the baseboard on the west wall, and also have paint ghosts. Two plain round handrails are attached with brackets to 3-inch boards. These boards are located on the outer wall of the stairway.

Ceiling. This is typical.

Doorways and Doors. There is a doorway on the west wall of the stair hall leading to the basement. The doorway surround may date to circa 1900 (fig. 76). Its south side is 5 3/8 inches wide, while its north side is 4 1/4 inches wide. The door is typical and painted off-white.

Window Openings. None.

Electrical Fixtures. There is a triple light switch on the north wall. It is made of off-white plastic. On the ceiling there is a single bulb fixture and a fire alarm/smoke detector.

Heating Elements. None.

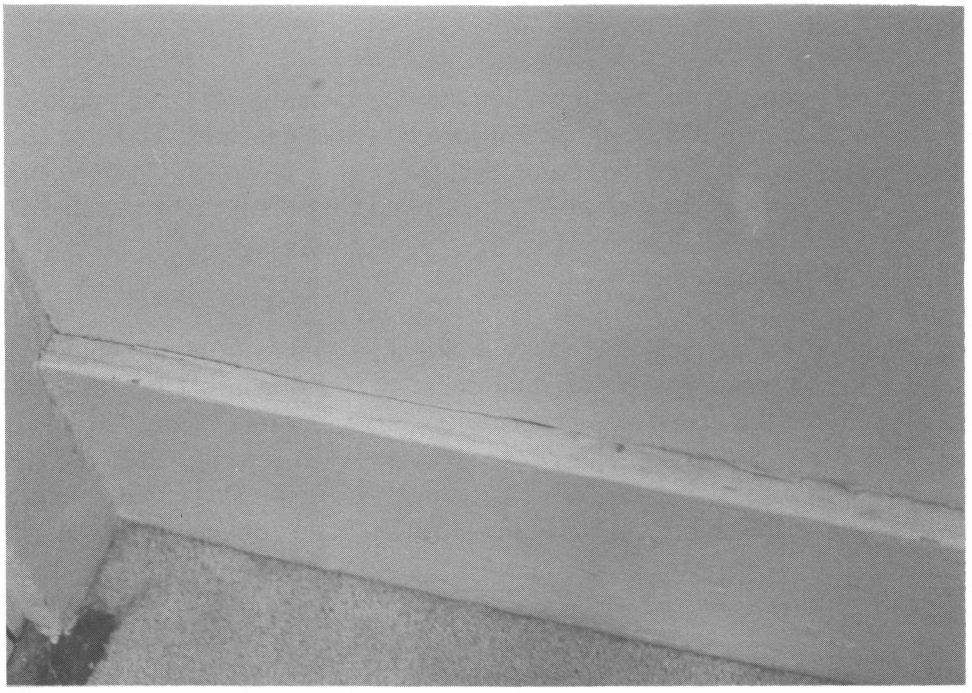


Figure 75. Room 104, baseboard with paint ghost.



Figure 76. Room 104, trim of doorway to basement.

Room 105 - Southwest Room

The main, west entrance of the Keeper's Dwelling leads into a room that measures 16 feet 3/4 inches by 11 feet 10 3/4 inches. All of the fabric in this room except the exterior door has been replaced.

Floor. This is typical.

Walls. These are typical. A wall jog in the northeast corner extends one foot into the room. (See appendix A.)

Ceiling. This is typical.

Doorways and Doors. There are three doorways in the southwest room, all of which have typical surrounds. The main doorway to the outside is at the south end of the west wall (fig. 77). The wooden door here contains four lights above three recessed horizontal panels. A white vinyl shade covers the glazed portion of the door. A curtain rod with valence hangs above the shade. The hinges are three-knuckled and unpainted. The brass knob is locking and unpainted. The door is painted off-white.

A second doorway is at the west end of the north wall. It leads to a bathroom and is typical. A third doorway, to Room 103 (the southeast room), is located on the east wall. The opening is 2 feet 9 1/2 inches wide but does not contain a door.

Window Openings. Two window openings exist in the southwest room. One is located on the south wall; the other is located on the west wall. They are both typical.

Electrical Fixtures. There is a single-switch wall plate south of the west doorway, and a double-switch wall plate east of the north door.

Heating Elements. Typical baseboard heating fixtures are located on the south and west walls. A thermostat is located south of the doorway on the east wall.



Figure 77. Room 105, doorway to exterior.

Room 106 - Bathroom

A half bath is located in the northwest corner of the main house, off Room 105 (the southwest room). Its dimensions are 6 feet 3 inches by 7 feet 6 inches. The toilet is in the northeast corner, and the shallow-bowl porcelain sink is adjacent to it on the east wall. The floor is covered with of one-inch-square ceramic tiles with white grout. The walls and ceiling are covered with plasterboard. There is a baseboard molding 4 3/4 inches high and a chair rail 4 1/4 inches high. All moldings and walls are painted off-white; the ceiling is painted white. There is a single-tube fluorescent light fixture over the sink.

Second Story

Room 201 - Stair Hall

The stair hall discussed in the first-story section continues to the second story. The overall dimensions of the room are approximately 6 feet by 9 feet. The floor-to-floor height is 8 feet 10 1/2 inches.

At the top of the stairway is a small landing area with a wooden handrail and square balusters along the south and west edges. A plain bead trims the lower end of the landing's fascia board (fig. 78). There are three newel posts: one at either end of the balustrade, and one at the corner. The assemblage is stained dark; it is a recent addition. An extension of the stair hall (Room 201B) leads from an east doorway to the second-story bathroom and southeast chamber.

Floor. This is typical.

Walls. These are typical, with plain baseboards 3 inches high painted an off-white color on each wall (fig. 79). The baseboards were not replaced during the 1992 renovation; they may date from the 1900 renovation.

Doorways and Doors. All doors are typical and painted white. Door heights vary. The doorway to the southwest chamber (Room 205) is located on the south wall. The doorway to the Ell Chamber (Room 202) is angled at the south end of the east wall. The hall extension (Room 201B) leads from doorway at the north end of the east wall to the bathroom and southeast chamber. The moldings around the doors are plain boards of widths varying between 3 and 4 inches. At the top of the doors to Rooms 203 and 202, an additional board has been layered over the trim (fig. 80). The purpose for this is unknown. The door trim around the doorway to Room 204 seems to have been fitted over existing trim (fig. 79). All moldings and trim are painted off-white.

Window Openings. There is one typical window opening on the north wall. The surround is plain and painted off-white.

Electrical Fixtures. A single bare bulb hangs from the ceiling above the stair.

Heating Elements. There are no heating elements in the hallways.

Other. There is a smoke detector located on the ceiling above the stairs.

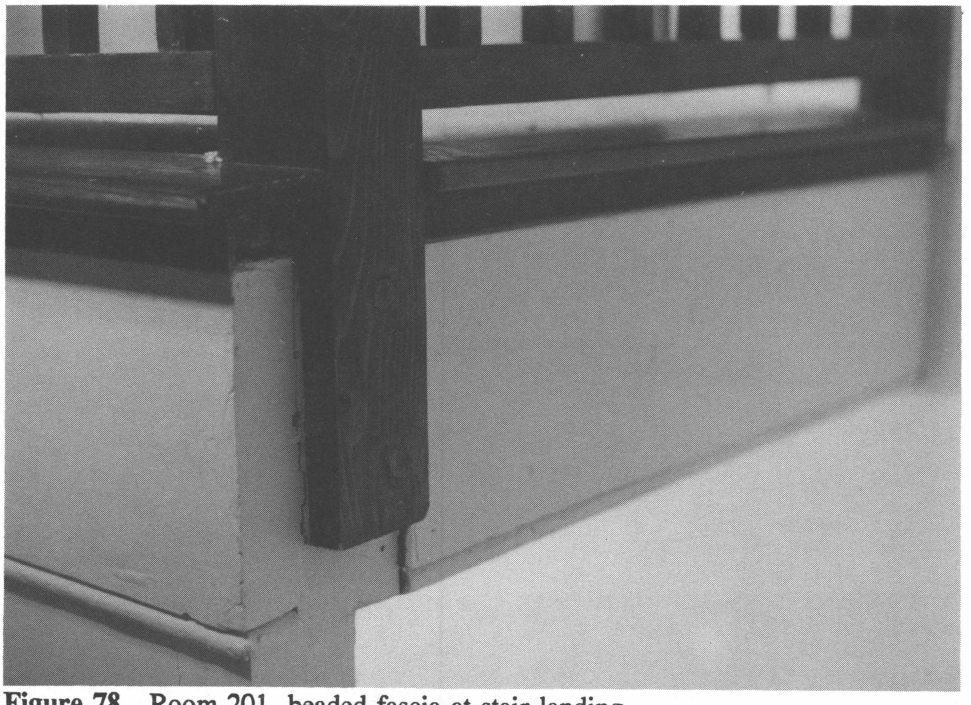


Figure 78. Room 201, beaded fascia at stair landing.

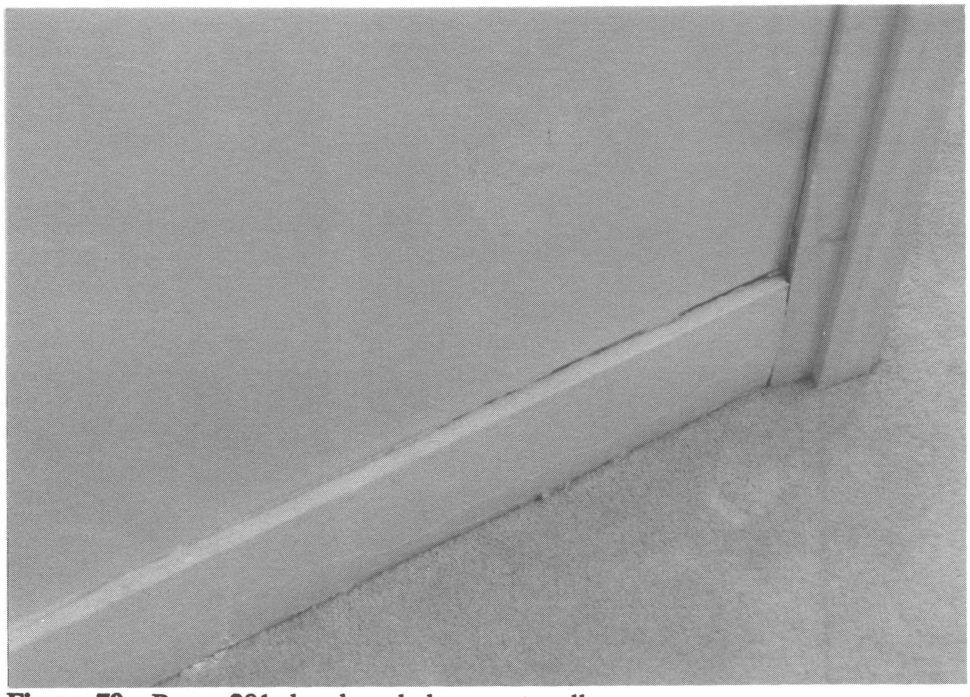


Figure 79. Room 201, baseboard along east wall.

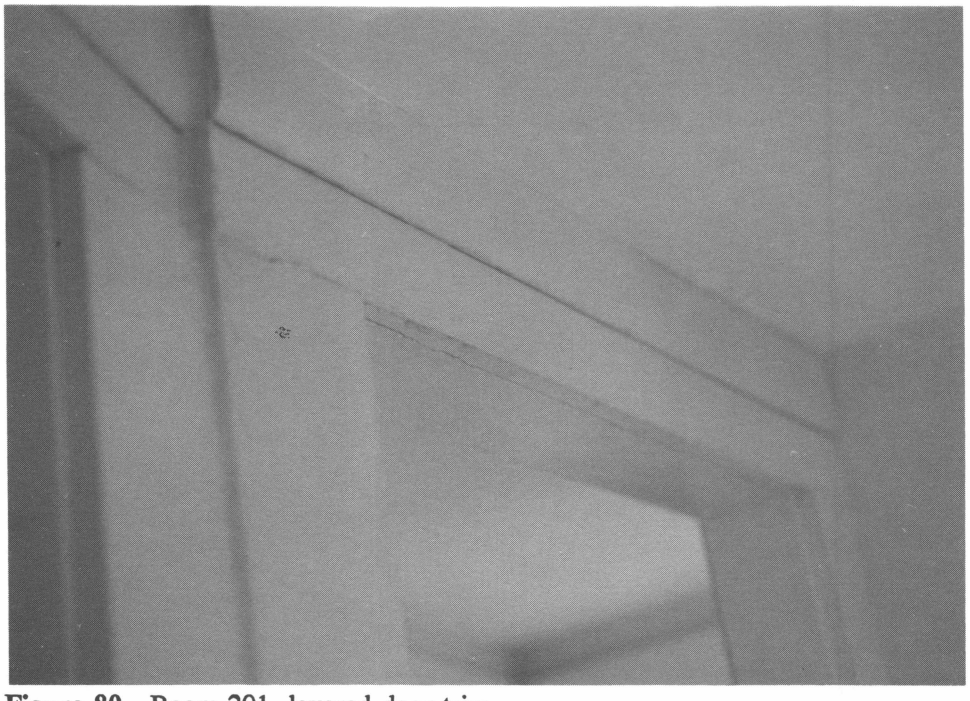


Figure 80. Room 201, layered door trim.

Room 202 - Ell Chamber

The dimensions of this room are 17 feet 9 1/2 inches by 12 feet 4 inches. Nearly all of the ceiling is sloped, reflecting the ell's roof line. There is a crawl space "closet" at the west end of the north wall (Room 202a). The southwest corner of the room has a diagonal wall; the southeast corner has a double jog inward (fig. 81).

Floor. This is typical.

Walls. The east and west walls are knee walls 2 feet 7 1/2 inches high. They are otherwise typical, with a baseboard. The height of the baseboard ranges from 5 1/2 inches at the southeast corner to 7 1/4 inches on the west wall, near the doorway to the room. It consists of a single plain board painted off-white.

Ceiling. The ceiling is typical but painted off-white.

Window Openings. There is one window opening on the west wall and one on the north wall. Both are typical, except the north-wall window opening is smaller than normal: it is only 2 feet 1/2 inches wide.

Doorways and Doors. The doorway into the room is in the diagonal southwest corner of the room; it leads from the stair hall (Room 201). It is typical. On the north wall, a small door to a crawl space is made of plywood that has been painted off white. The door has gold-toned hinges, a rounded handle, and a locking bolt.

Electrical Fixtures. None.

Heating Elements. A typical baseboard heating unit exists along the west wall.

Closet. The flooring of the crawl space is boards that run north-south, and which are painted dark gray. The walls of the crawl space are covered with plaster and wood baseboard. Both are painted off-white.



Figure 81. Room 202, southeast corner.

Room 203 - Bathroom

A bathroom is located between the ell chamber (Room 202) and the southeast chamber (Room 204). It measures 10 feet 11 inches by 8 feet 2 inches. Plumbing for the second-story bathroom was added in 1909. A porcelain bathtub measuring 4 feet 10 1/2 inches by 3 feet 1/2 inches is located along the west half of the north wall. The porcelain toilet is located on the same wall east of the tub. A wall 4 3/4 inches thick separates the bathtub from the toilet and contains an access panel for the plumbing. The white porcelain sink is located at the east end of the south wall.

Floor. The floor is covered with the same vinyl composition tiles used in the kitchen.

Walls. The walls are typical with plain baseboards, all painted off-white.

Ceiling. This is typical.

Doorways and Doors. These are typical.

Window Openings. A typical window opening is located at the center of the east wall. The trim around the window is plain boards. The window and trim are painted off-white.

Electrical Fixtures. A single-bulb fixture is located on the ceiling.

Heating Elements. A typical baseboard unit is located on the east wall.

Room 204 - Southeast Chamber

The dimensions of this room are 13 feet by 10 feet 7 inches. A dormer on the east wall is approximately 4 feet wide. There is a shallow closet (Room 204a) near the center of the west wall.

Floor. Typical.

Walls. The north, west, and east walls are covered with unpainted simulated wood paneling. The south wall is covered with plasterboard, possibly dating from 1950 and painted off-white. There is a plain 6-inch wood baseboard on all the walls. This baseboard is painted off-white. A quarter-round cornice covers the juncture between the walls and ceiling.

Ceiling. The ceiling in the southeast corner of the room is sloped, reflecting the exterior roof line. It is covered with composite-board painted off-white that may date to 1950. The rest of the ceiling is flat; it is covered with plasterboard with battens that run east-west. An additional batten runs north-south near the south wall.

Doorways and Doors. The entrance doorway, at the west end of the north wall, and the west-wall closet doorway are typical. The trim around both doorways (figs. 83 and 84), painted off-white, does not match the trim found typically. It dates to the 1900 renovation.

Window Openings. There is a window just west of center in the south wall, and another in the east dormer. Both windows are typical, with plain trim painted off-white.

Electrical Fixtures. There is a single-switch plate on the west wall. There is a two-bulb fixture with glass and metal cover in the center of the ceiling.

Heating Elements. There is a baseboard heating unit on the south wall.

Closet. The closet on the west wall is 6 feet wide and 1 foot 10 1/2 inches deep. The floorboards inside the closet run north-south. The closet walls are plaster with baseboards, both painted off-white. The closet contains circa-1900 fabric (see app. B.) An opening in the closet ceiling leads to the attic; it measures 1 foot 7 inches by 1 foot 4 inches.

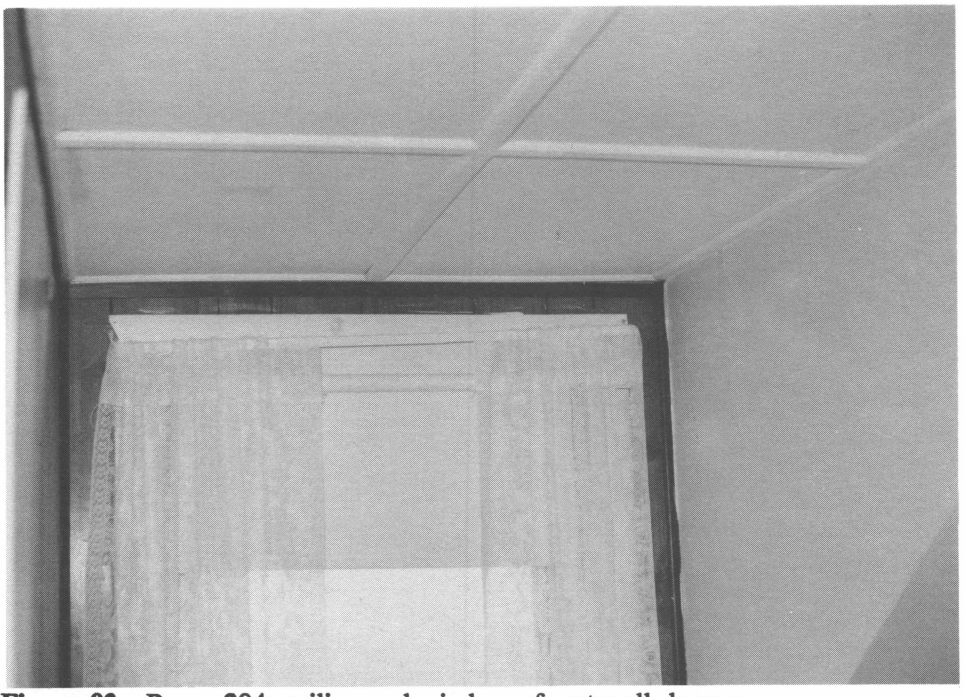


Figure 82. Room 204, ceiling and window of east-wall dormer.

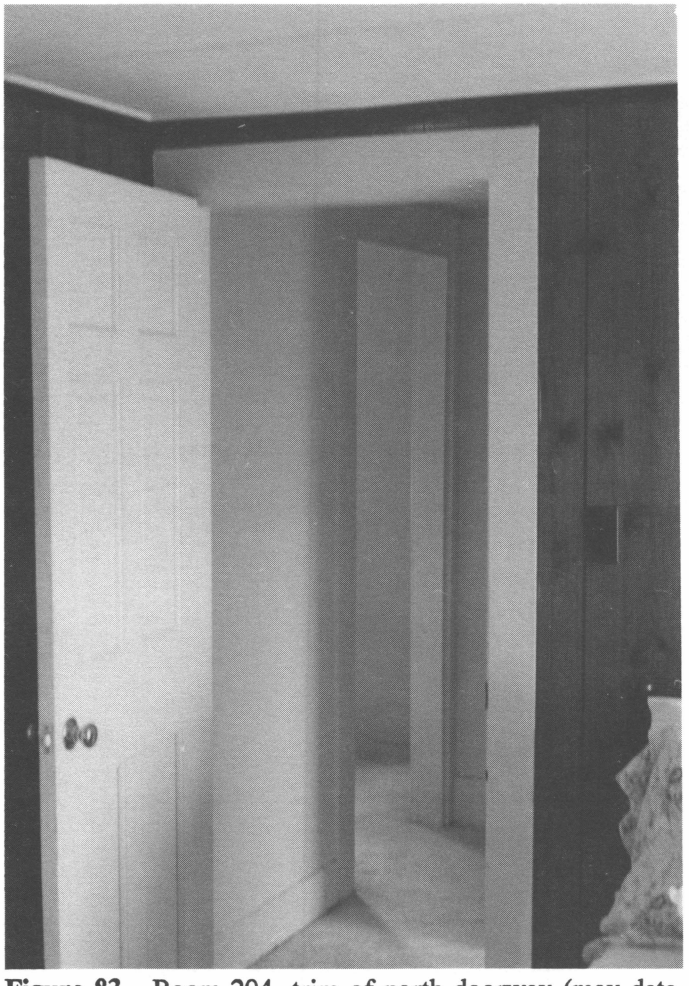


Figure 83. Room 204, trim of north doorway (may date to 1900 renovation).



Figure 84. Room 204, trim of west closet doorway (may date to 1900 renovation).

Room 205 - Southwest Chamber

The southwest chamber measures 16 feet by 11 feet 2 inches. A dormer on the west wall is approximately 4 feet wide. A closet (Room 205a) is located at the east wall; a crawl space (Room 205b) is at the west end of the north wall.

Floor. This is typical.

Walls. The walls are covered with simulated wood paneling. The dormer walls are plasterboard covered with wallpaper. Each wall has a plain 6-inch-high baseboard painted white. At the top of the simulated paneling, a black trim bands 2 1/2 inches high meets the 1-inch-high white ceiling trim.

Ceiling. The ceiling is covered with white-painted composite board and wood battens, possibly dating to 1950. The ceiling of the west half of the room is sloped, reflecting the exterior roof line.

Doorways and Doors. The doorway into the room from the stair hall (Room 201a) is at the east end of the north wall. It is a typical doorway with typical door and trim, all painted white. The closet door (fig. 85), located at the south end of the east wall, is a four-panel door with plain gold-toned rounded handle and latch lock. The hinges are five-knuckled. The door is painted white. The interior side of the door has raised panels (fig. 86). The trim around the door is made of plain wooden boards painted white. The door to the crawl space, at the west end of the north wall, is not full height, and only 1 foot 10 1/2 inches wide. It is composed of vertical beaded boards 6 inches wide. The door is painted white and has a gold-toned, rounded handle. The trim around the door is made of plain boards also painted white.

Window Openings. There is a window near the east end of the south wall, and another in the west dormer. Both windows and their trim are typical, painted off-white.

Electrical Fixtures. There is a single-bulb fixture in the center of the ceiling.

Heating Elements. A typical unit is located on the west wall.

Closets. The dimensions of the closet are 5 feet wide by 1 foot 11 inches deep. The building fabric inside the closet dates to circa 1900 (see app. B). The crawl space is 3 feet 4 inches wide and 6 feet 3 inches deep. The floorboards of both the closet and the crawl space run north-south and are painted dark gray. The walls of both are plastered and painted off-white. All walls have plain baseboards, also painted off-white. A vent pipe extends through the northeast corner of the crawl space.



Figure 85. Room 205, closet doorway at southeast corner.

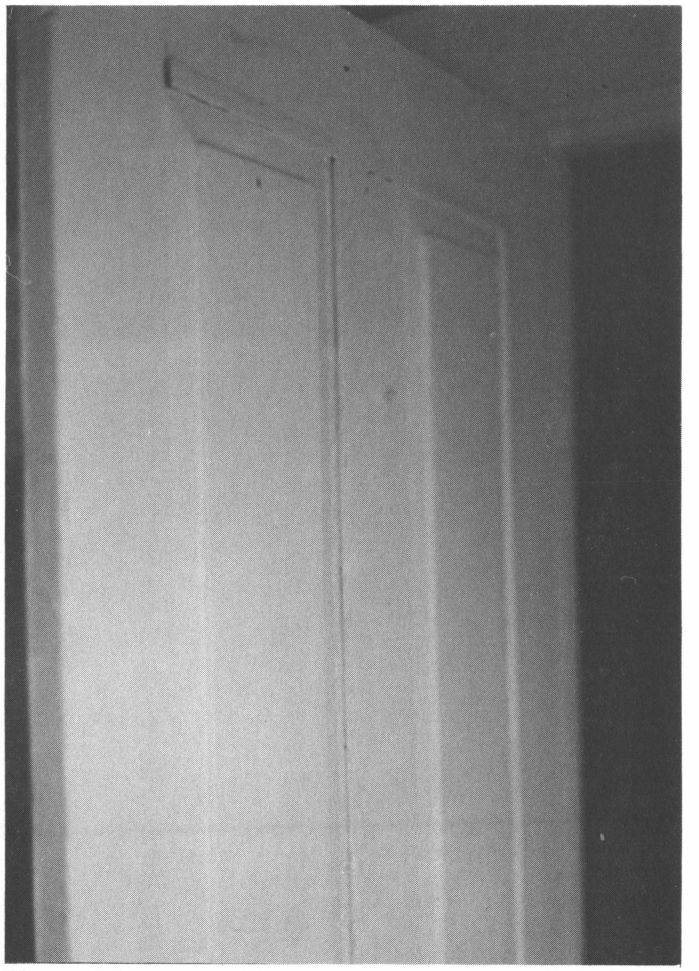


Figure 86. Room 205, interior side of closet door.

Attic

Room 301

The only access to the attic is through the ceiling of the closet of the southeast chamber (Room 204a - see app. A). The floor framing is composed of joists 2 inches by 6 1/2 inches, approximately 2 feet on center. The rafters are 3 inches by 5 1/2 inches and butt at the ridge. There is no access to the space under the dormer gables from the attic. The structure's gable ends have secondary nailers parallel to and approximately 5 inches below the end rafters. The brick chimney passes through the center of the ridge.

Connector at the Keeper's Dwelling

First Story

Room 107 - Vestibule

The north end of the Connector at the Keeper's Dwelling contains a small vestibule. Due to the 5-degree offset of the connector from the dwelling, the room is trapezoidal in plan, with each wall varying in dimension. The west wall is 4 feet 10 inches, the east wall is 4 feet 2 inches, the south wall is 4 feet 1 inch, and the north wall is 3 feet 1 inch. The room is accessed by a doorway from the Keeper's Dwelling kitchen (Room 103). The door is 2 feet wide. One tread descends from the level of the doorway's threshold to the floor of the vestibule. It is 1 foot 3 inches wide at the west wall, tapering to 1 foot in width at its east end. A doorway in the south wall leads to Room 108. Its fabric appears to be early. The four-panel wood door has a burl knob, and is painted white. There are no windows, light fixtures, or heating elements in this room.

Room 108 - Connector Room

The dimensions of Room 108 are 3 feet by 4 feet 10 inches. A partition dividing this room from Room 110 was installed in 1987.

Floor. The floor is covered with red and black industrial carpet.

Walls. The walls are covered in simulated wood paneling with plain wooden baseboards. The plain baseboards are painted white.

Ceiling. The ceiling is covered with white-painted plasterboard.

Doorways and Doors. The doorway to Room 107 (fig. 87) is in the north wall. Its surround is 4 3/4 inches wide, with a half-inch bead, and is painted white. Its door is four-paneled with a burl wood knob, and is painted white.

Window Openings. There is a window opening with double-hung, six-over-six wood sashes in the west wall. A top lock is located at the meeting rails. The window sashes and surround are painted white.

Electrical and Heating Equipment. None.

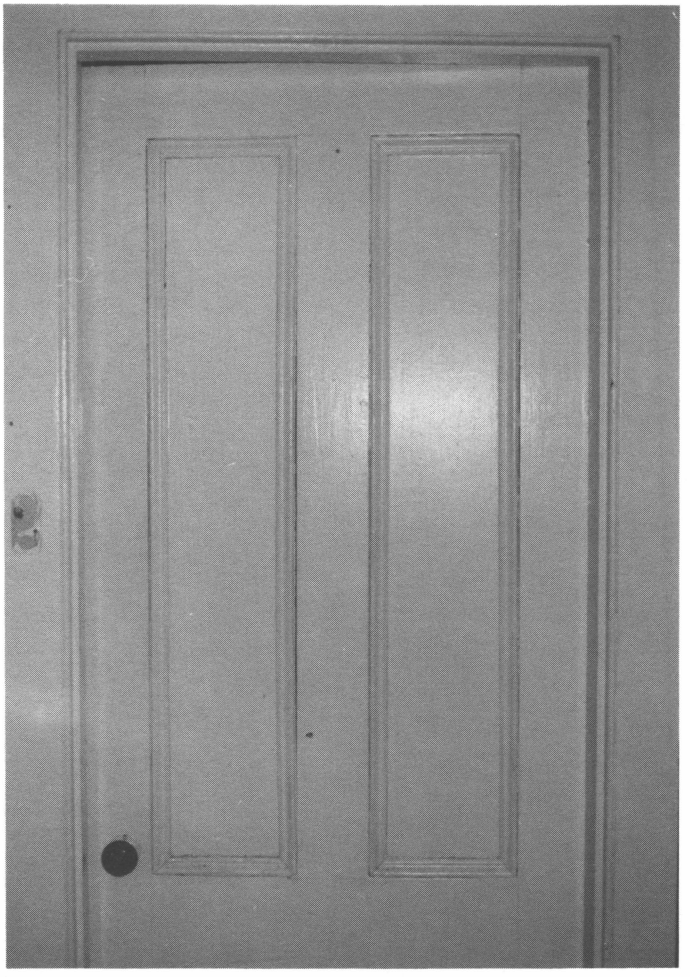


Figure 87. Room 108, door to Room 107.

Room 109 - Tower Entry

This room is located at the jog formed where the west walls of the narrower Connector at the Keeper's Dwelling and the wider Tower Connector meet. It measures 4 feet 8 inches by 4 feet 7 inches. It has a doorway to the exterior in its east wall, and a doorway to Room 110 in its west wall. The west end of the room is a remnant of the connector that formerly linked the Assistant Keepers' Dwelling to the Connector at the Keeper's Dwelling. When the Assistant Keepers' Dwelling was torn down, most of its connector was demolished. Its west end was rebuilt to create a new entry for the Tower.

Floor. The concrete floor is covered with vinyl composition sheet flooring.

Walls. The north, east, and south walls are of concrete block painted white; these date to the addition of the entry. The west wall is brick, also painted white; it is original, dating to the construction of the lighthouse in the 1850's. At the base of the north, south, and west walls, a red stripe 4 inches high is painted in place of a baseboard.

Ceiling. The ceiling is plywood painted white.

Doorways and Doors. The exterior doorway in the east wall contains a large unpainted metal door. The distance from grade level down to floor level is 7 inches. The concrete step was installed circa 1900, and is painted red. The west-wall doorway to Room 110 has had its door removed. The board surround has a half-inch bead, and is an early installation now painted off-white. A section of the north side of the surround was removed near floor level (fig. 88). Ghosts of hinges and locks are seen on the doorway frame.

Window Openings. None.

Electrical Fixtures. An industrial electrical switch box with two red handles is located on the south wall. A single-bulb metal light fixture is located at the center of the ceiling, connected to the switch by gray surface-applied conduit.

Heating Elements. None.

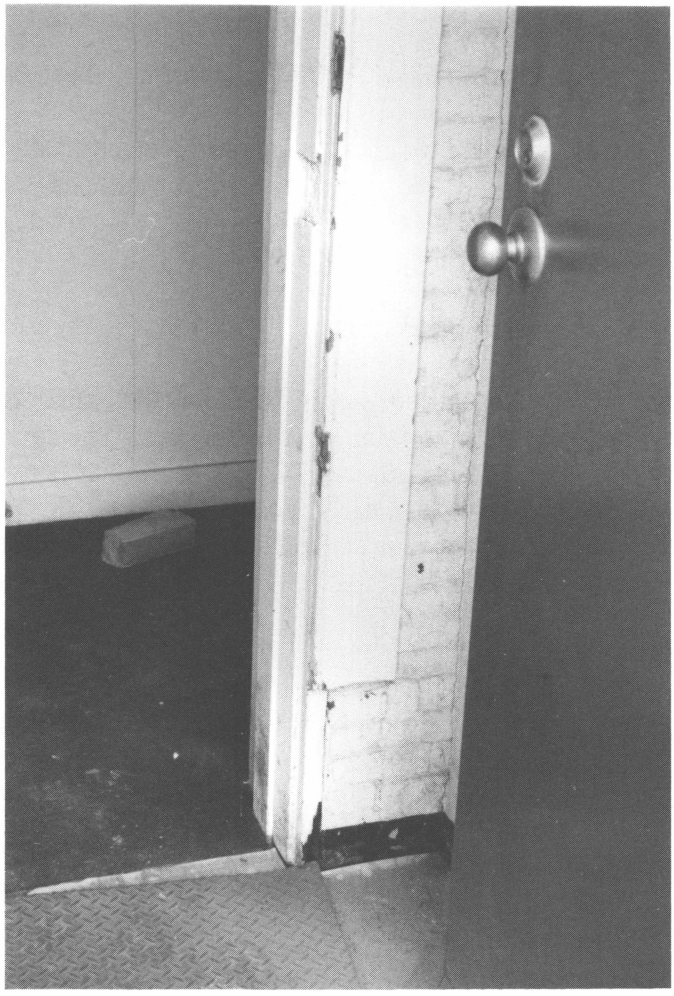


Figure 88. Room 109, west doorway to Room 110 (note trim).

Room 110 - Corridor

Room 110 is bounded on the north by the Connector Room (Room 108), on the east by the Tower Entry (Room 109), and on the south by the Equipment Room (Room 111) in the Tower Connector. It measures 5 feet 4 inches by 4 feet 2 inches. Prior to the construction of its north wall in 1987, the room opened directly to Room 108.

Floor. The concrete floor is covered with brown and black speckled industrial carpet.

Walls. The north wall (above the doorway) and the south wall are of white-painted plywood. The west wall contains a large section of white-painted plywood used to block up a former doorway. The east wall has the doorway to Room 109. A plain white-painted baseboard 4 1/4 inches high is present on all walls.

Ceiling. The ceiling is plywood painted white.

Doorways and Doors. There is no doorway to Room 108. There is no door in the doorway to Room 109. The surround of the south-wall doorway to Room 111 is 5 1/2 inches wide (fig. 89). It is of plain boards painted off-white, and appears to be early.

Window Openings, Electrical and Heating Equipment. None.



Figure 89. Room 110, south doorway to Room 111 (note trim).

Tower Connector

First Story

Room 111 - Equipment Room

This is the only room in the Tower Connector, which links the Connector at the Keeper's Dwelling to the Tower proper. It measures 10 feet 7 1/2 inches by 11 feet 4 inches. Currently, it houses all of the equipment necessary to run the unmanned light.

Floor. The concrete floor is covered with gray rubber panels in a raised diamond pattern.

Walls. The walls are covered with plywood painted white. The baseboards are plain and also painted white. A passage through the brick wall of the Tower exits at the south end of the room; its brick walls are painted white. The passage narrows from 2 feet 11 inches at its north end to 2 feet 9 inches at its south end.

Ceiling. The ceiling is acoustical tile in a grid 2 feet square.

Doorways and Doors. There are two doors. The north-wall doorway to Room 110 has a new, unpainted wood door. It is recessed 7 1/2 inches from the wall. It has an early, Italianate-style surround (see app. B and fig. 90); a plain silver-tone round knob; and five-knuckle hinges.

The other door (fig. 91) is located at the south end of the passage to the Tower. It has a metal frame painted gray. The four-paneled iron door hangs on strap hinges and has a pull ring. The door measures 29 1/2 inches wide by 72 inches high. The panels are 9 inches wide and 23 inches high. A new slide-bolt is placed directly below the ring pull. A large key hole with curved plate is located near the new lock. The door is painted gray with black paint highlighting the strap-hinge rivets. Black-painted raised letters spell: "U S Truro Light House 1840." This door was apparently installed in the second (circa-1833) lighthouse during alterations circa 1840, and was subsequently salavaged and reused during the building of the third (1857) lighthouse.

Window Openings. There is a fixed double-glazed picture window on the west wall. It dates to 1987. It is 3 feet 9 inches wide, with a plain wood surround and sill, both painted white.

Electrical Fixtures. Many pieces of equipment are located along the east wall of the room. Their functions vary, but most support the operation of the beacon and transmitter. A telephone/intercom system instrument is located on the south wall adjacent to the passage to the tower. The system works by cranking a handle, then speaking into the receiver. Another telephone instrument on the Watch Deck is connected to this one.

Heating Elements. There is a small electric heater mounted at the south end of the east wall about 2 feet from the floor.

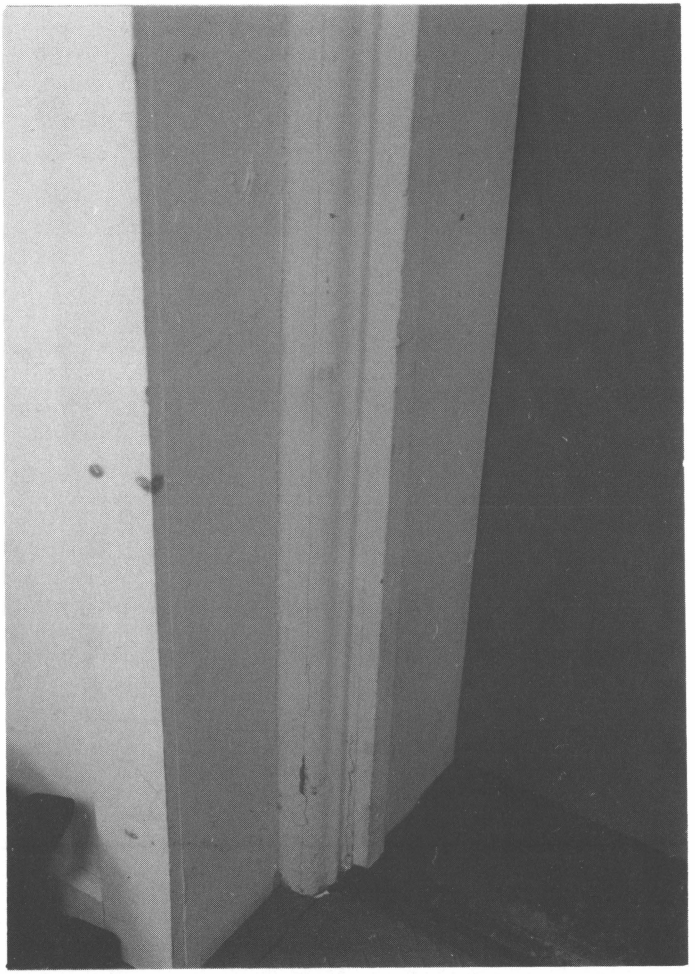


Figure 90. Room 111, Italianate molding at doorway to Room 110.

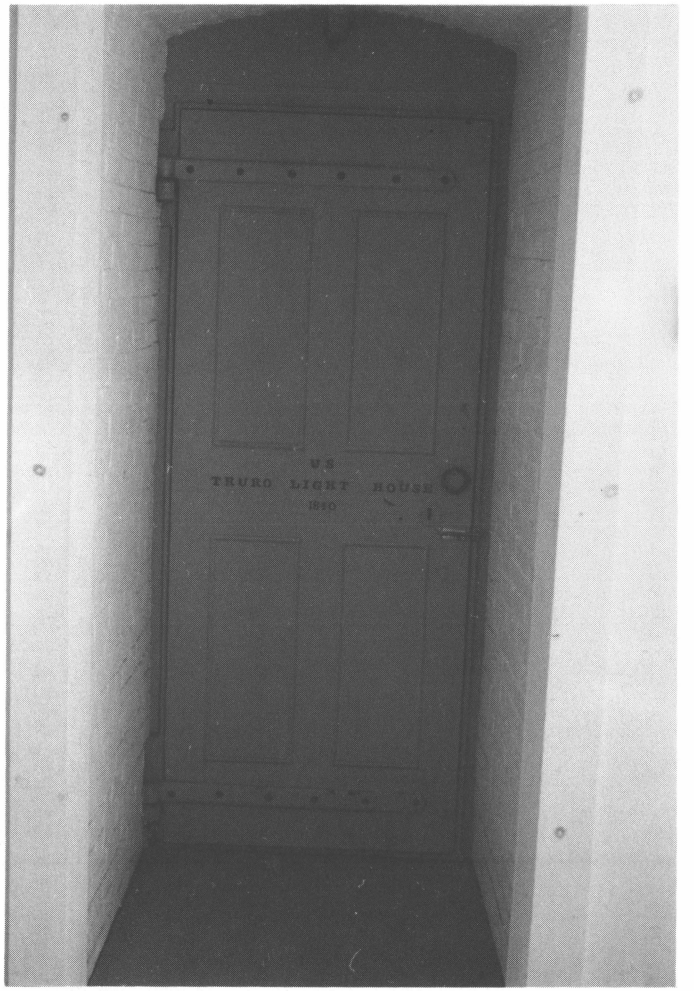


Figure 91. Room 111, iron door leading to tower (Room 112).

Tower

General Information

The entire tower has been assigned the room number 112. There are no heating elements in the space.

First Level and Stair

The diameter of the First Level is 10 feet 1 1/2 inches. A cast-iron stair curves up to the Half Deck, following the inside curve of the Tower walls. While the exterior walls taper from the base as they rise up to the underside of the Watch Gallery, the interior walls of the Tower are plumb).

Floor

The floor on the First Level is concrete painted red. A large rectangular concrete floor patch is located off-center, oriented northwest by southeast. The unpainted patch measures approximately 2 feet 8 inches by 5 feet. A metal plate, secured by screws into the floor, is perpendicular to the entry opening. It is 6 inches wide by 4 feet 4 inches long, painted red.

Walls

The walls throughout the Tower are unpainted red brick. The average brick size is 4 inches wide by 2 inches high, with an average joint width of three-eights of an inch. Although more regular sizes were also used sporadically, it is difficult to tell which are headers and which are simply small bricks. Seven evenly spaced holes are cut through the wall, one course above the floor level (fig. 92). The holes are two wythes high and approximately one brick in length. The purpose for these holes is presumably for ventilation purposes. Pairs of bolt holes are seen west of the window openings on the southwest side of the wall (fig. 93). The purpose of the bolt holes has not been determined. Above the beginning of the stair, the names of those who worked on the exterior repainting and its completion date are painted on the brick wall with black paint on a white background. The date on this sign is "20 September 1991." There are six names associated with the project.

Ceiling

There is no ceiling.

Doorways and Doors

The iron door in the north-wall doorway to Room 111 has been discussed in some detail in connection with Room 111. A brick arch three courses in height forms the header of the doorway on this side. Below the brick arch, a metal plate has been fitted into the opening to form the frame of the door. Bolts from the strap hinges on the opposite side of the door are visible. A large key hole with a rectangular plate is located just above a ring door pull.

Window Openings

Two window openings 9 1/2 inches apart are inset approximately 2 feet 10 inches into the south side of the Tower wall. The bottom of the windows' granite sills are 12 courses above the floor. The openings measure approximately 3 feet 1 1/2 inches wide by 4 feet 3 inches high. Each opening has a lintel 1 foot 7 inches deep, consisting of seven steel angles. They are painted blue-green. The sills are of gray granite 9 inches high. The window openings are filled with glass blocks. Cement patches at the junction between the glass blocks and the jamb, as well as a concrete layer over the brick near the opening, give evidence of an earlier frame (see figure 94). A paint ghost of a former exterior paint finish is evident at the jamb at the glass block.

Electrical Fixtures

Wires and cables lead into Room 111 in the Tower Connector and continue up to the Watch and/or Lantern Deck. A wall outlet is located immediately west of the entry door. A box above the doorway contains the equipment for the intercom telephone system.

Stair

The open stairway to the Half Deck was built in 1903. It begins near the east side of the doorway to Room 111. The treads measure 1 foot 10 1/2 inches wide and 10 1/4 inches deep at the wall, narrowing to 6 1/2 inches at the railing. The treads (fig. 95) consist of steel plate with a raised diamond pattern within a plain border. The stair has two landings. The flight to the first landing has 16 treads; the flight from there to the second landing has 12 treads, and the flight to the Half Deck has 12 treads. The landings are curved, having a steel-plate floor with a raised diamond pattern and painted yellow.

The stair is bolted at intervals to the brick wall of the Lighthouse Tower. There is no stringer: the individual steps are bolted to each other vertically by the threaded rods that serve as the balusters for the handrail, each of which passes through two steps. The bottom of the rod is bolted by a cap nut. All of these elements are painted black.

The stair balustrade has a wooden handrail and newel post, and wrought-iron balusters square in section. The handrail and newel (fig. 96) are unpainted; the balusters are painted black. The handrail shows signs of possible alteration. Its grooved underside has round holes where round balusters may have previously been fitted; the baluster spacing does not correspond to the existing spacing (fig. 97). The end of the rail near the newel post may have been cut.

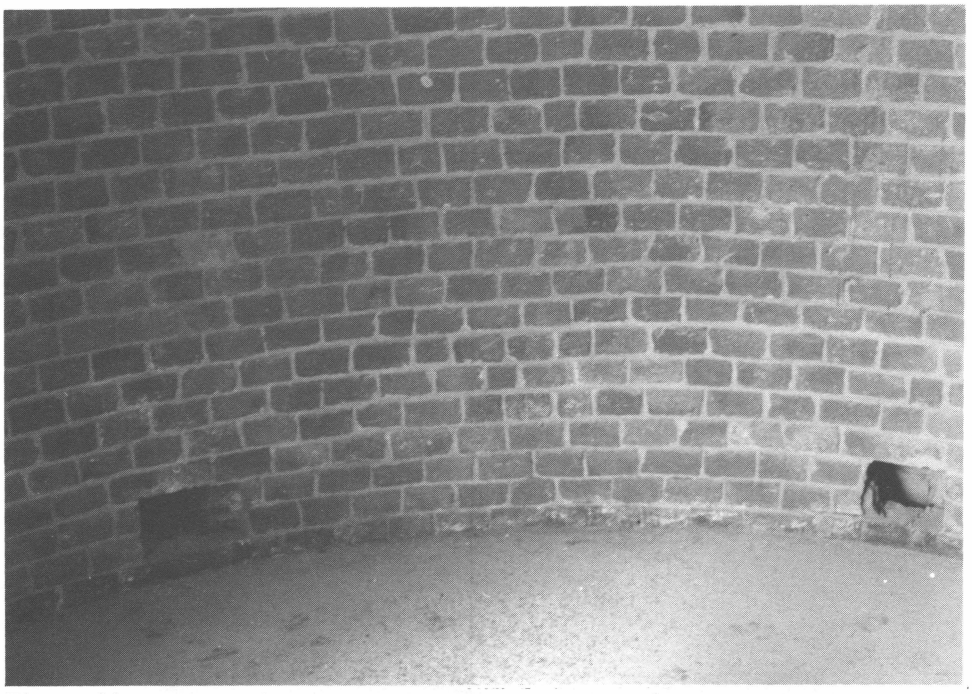


Figure 92. Room 112, evenly spaced holes at base of wall, First Level of Tower.

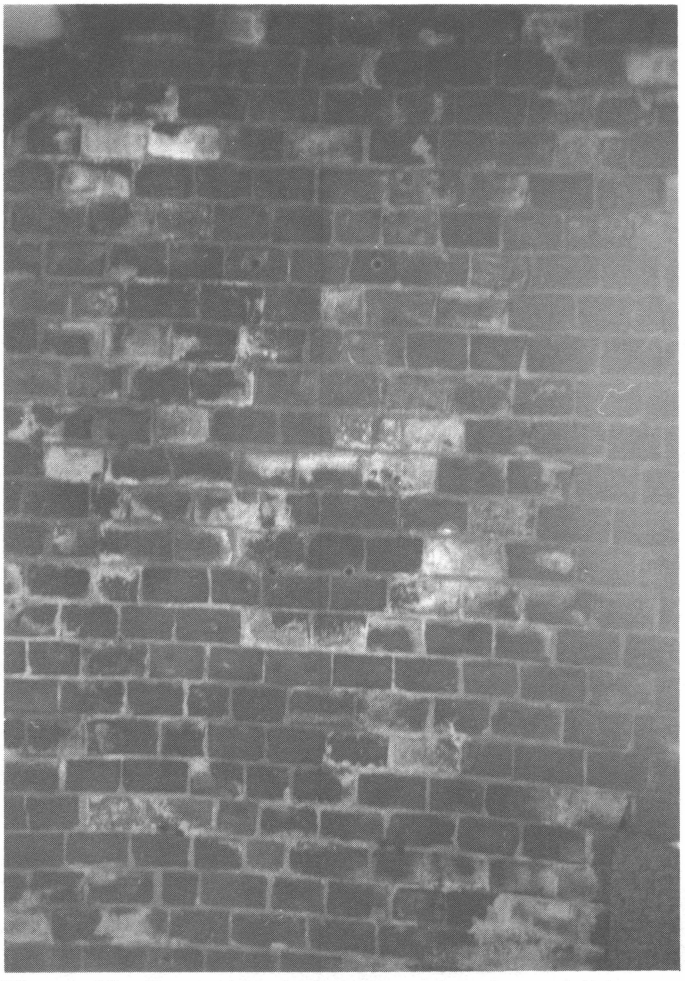


Figure 93. Room 112, bolt holes and anchors visible east of window openings, First Level of Tower.

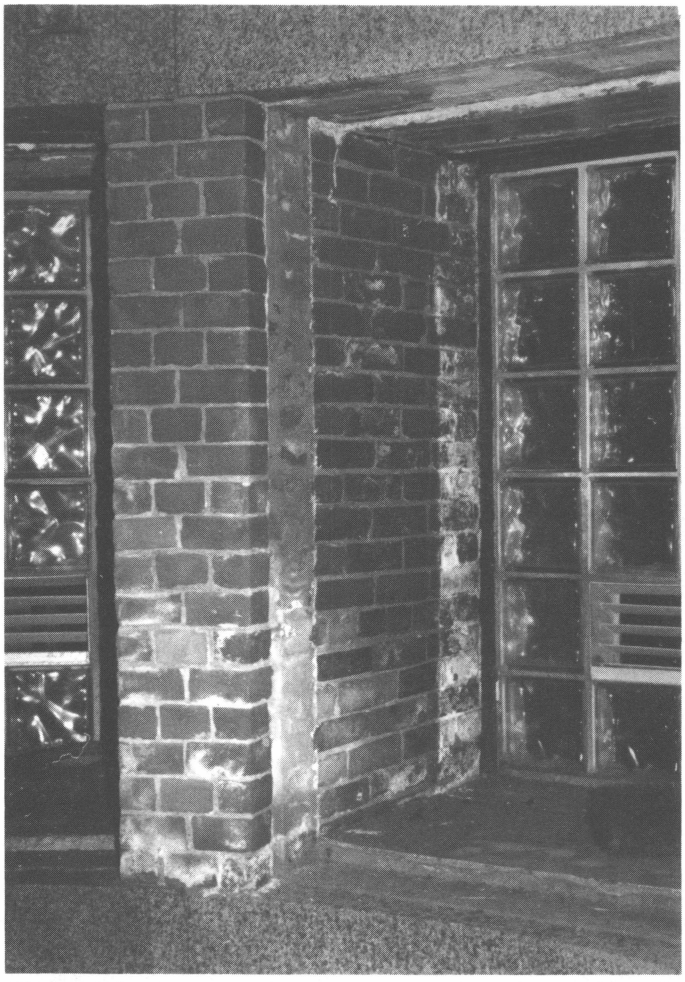


Figure 94. Room 112, window openings in south wall, First Level of Tower.

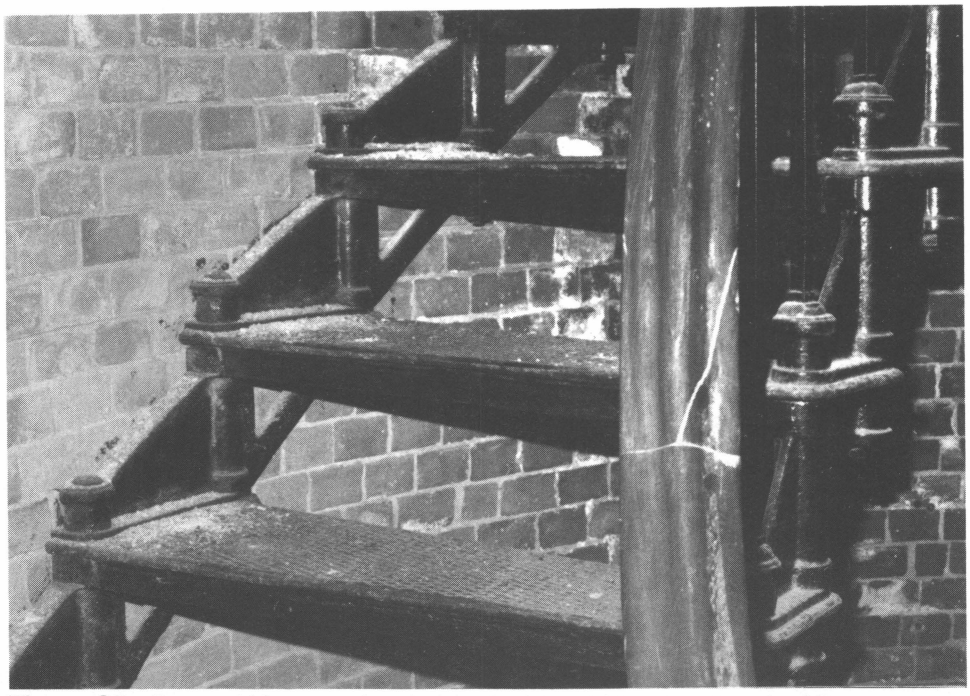


Figure 95. Room 112, curved stair installed in 1903, First Level of Tower.



Figure 96. Room 112, newel post and handrail of curved stair, First Level of Tower.

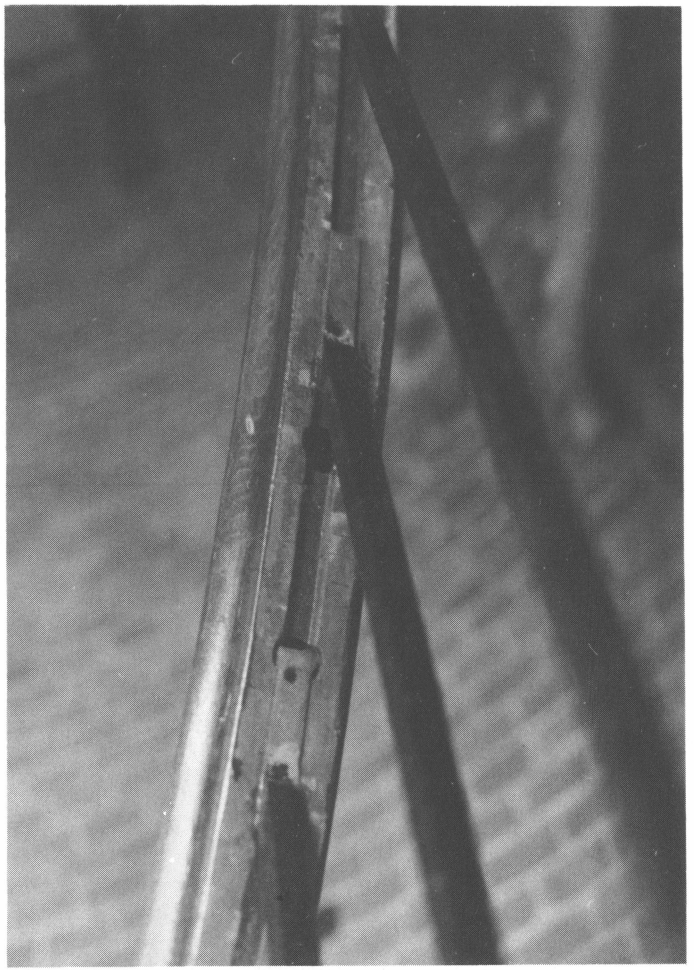


Figure 97. Room 112, underside of stair handrail at First Level of Tower, round holes at location of joint connector.

Half Deck

The Half Deck is semicircular in plan, with a radius of approximately 5 feet 6 inches. The floor is composed of three steel plates bolted together through perimeter flanges. The underside of the deck (fig. 98) is reinforced with intermediate stiffening webs, one set running parallel to the straight edge of the landing, the other set running perpendicular. A curved "ship" ladder with eight open, cast-iron treads ascends from the Half Deck to the Weight Deck (fig. 99). The treads have the same diamond pattern used on the First Level stair and Half Deck floor. The treads are bolted through their ends into two flat steel-plate stringers on each side; the stringers are bolted to the floor and the deck above. The stringers are painted black. The treads are painted red. A pipe rail is bent to form the post and railing on both sides.

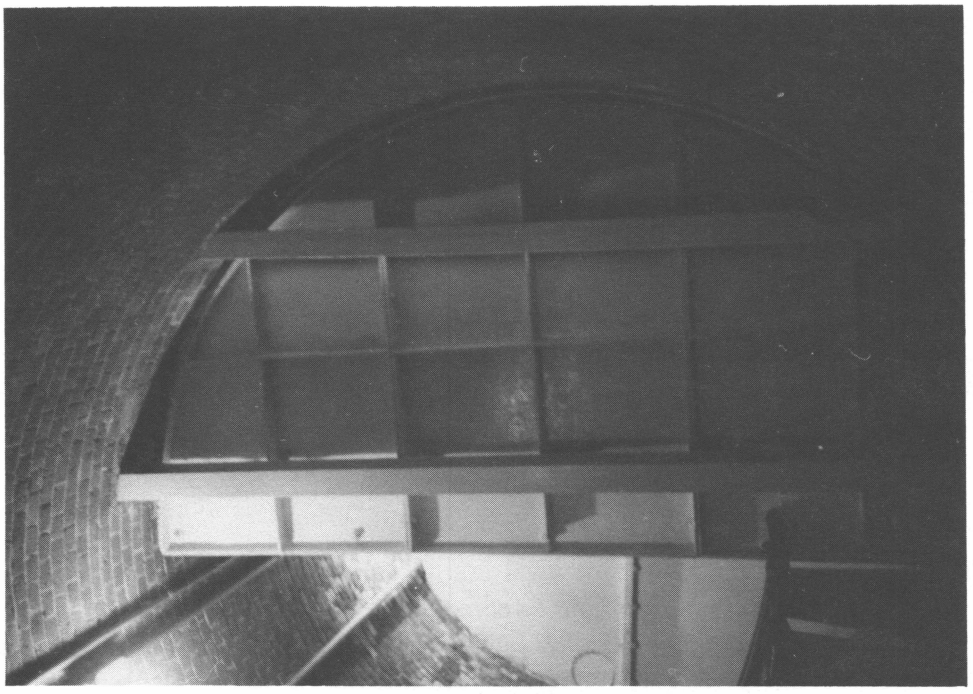


Figure 98. Room 112, underside of Half Deck.



Figure 99. Room 112, base of ladder ascending from Half Deck to Weight Deck.

Weight Deck

Floor

The circular floor consists of four sections of steel plate, all painted red. Two of the four sections have been cut to form an opening for the ship ladder to the Half Deck below. The opening is edged by a balustrade of wrought iron with square balusters. The newel post is topped with a knob. The balustrade follows the perimeter of the stair opening and curves in a half-circle at the center. All elements are painted black. For safety reasons, a yellow-painted plywood disk has been set over the center hole in the floor. Just off-center to the east is a red-painted round metal plate that is bolted to the floor (fig. 100).

Walls

The first course of bricks on this level are all either small bricks or headers. There is no consistent pattern of brick coursing. The three course of bricks nearest the ceiling are corbeled. One brick has been removed six courses below the ceiling in two locations, presumably for ventilation purposes. The granite sill for the doorway from the Watch Deck to the Watch Gallery is visible three courses above the top of the window on the north wall (see "Window Openings," below), off-center to the east. The granite sill is 1 foot 7 inches high, and interrupts the corbeling at that location (fig. 101). An eye bolt is located on the east section of the wall.

Ceiling

The ceiling (fig. 102) is the underside of the steel floor of the Watch Deck. An opening for the stair to the Lantern Deck above is located at the west side. A large cast-iron cone is located at the center of the plates, connected to four heavy I-beams. This cone formerly held the weights that operated the light.

Doorways and Doors

There are none.

Window Openings

A single window opening exists on the northwest side of the Tower wall (fig. 103). The window is one course above the floor level, with a granite lintel 5 1/2 inches high. The window opening is 4 feet 2 1/4 inches high. Steel lintels, steel frame, and the ghost of a former frame indicate that a change occurred to this window opening. It is currently filled with a panel of glass blocks, four units wide by six units high. The panel is inset approximately 1 foot 6 inches into the opening.

Electrical Fixtures

Gray cylindrical pipe conduit carries wires up the side of the north wall. Holes have been cut into the ceiling plates to allow the conduit to pass through to the Watch Deck. There is also a single-bulb fixture on the ceiling.

Stair

The stair between the Weight Deck and the Watch Deck is very ornate. The stringer ornamentation (fig. 104) consists of a double serpentine pattern divided by vertical members. All are painted black. The treads (fig. 105) are also cast iron with a woven elliptical and open-diamond pattern. The treads are painted red; their ends are set into the brick. The handrail and balusters are round and of wrought iron. The balusters are fastened into the handrail with bolted T-shaped plates that extend to fit over the balusters. The stair ascends to an opening in the floor of the Watch Deck that measures 3 feet 4 1/2 inches long and approximately 2 feet wide.



Figure 100. Room 112, floor plates and stair railing at Weight Deck.



Figure 101. Room 112, granite sill of exterior Watch Deck doorway (above) interrupting corbeling of Weight Deck.

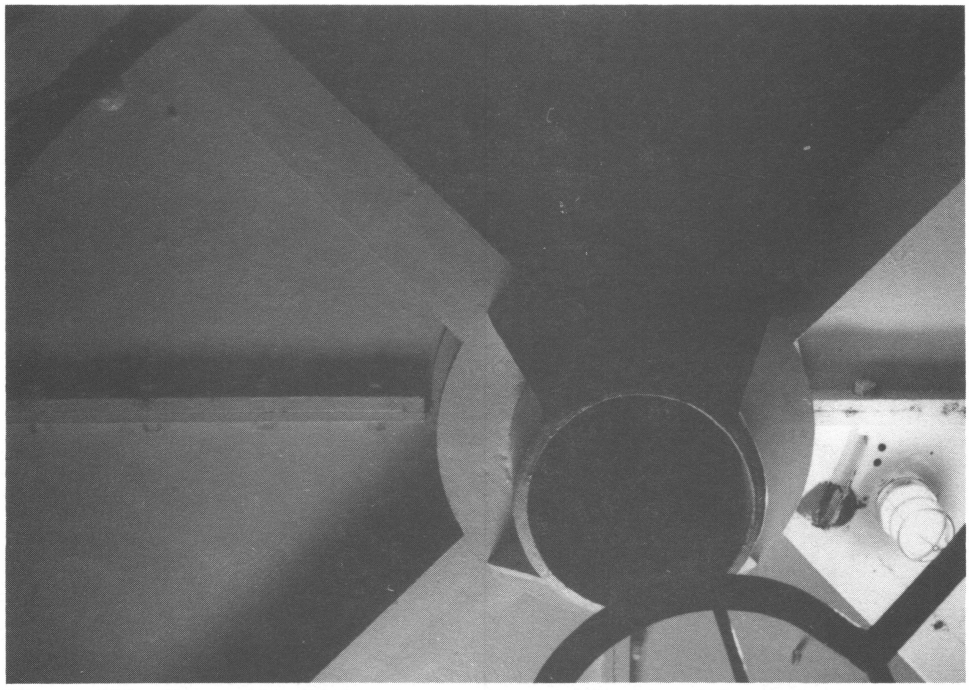


Figure 102. Room 112, Weight Deck ceiling (underside of Watch Deck).

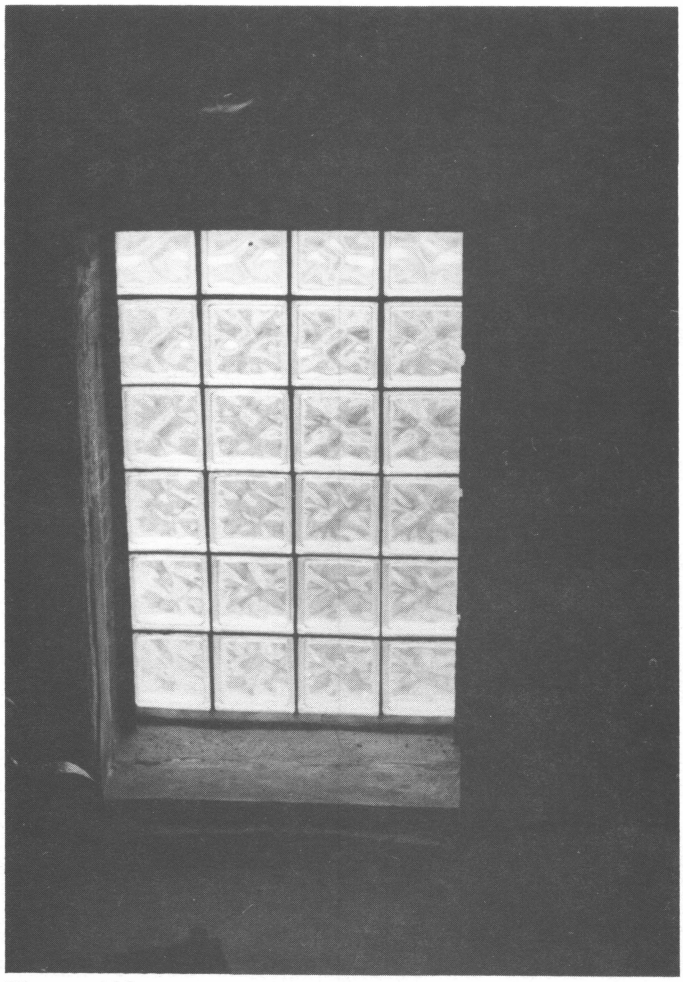


Figure 103. Room 112, Weight Deck window opening in northwest wall.

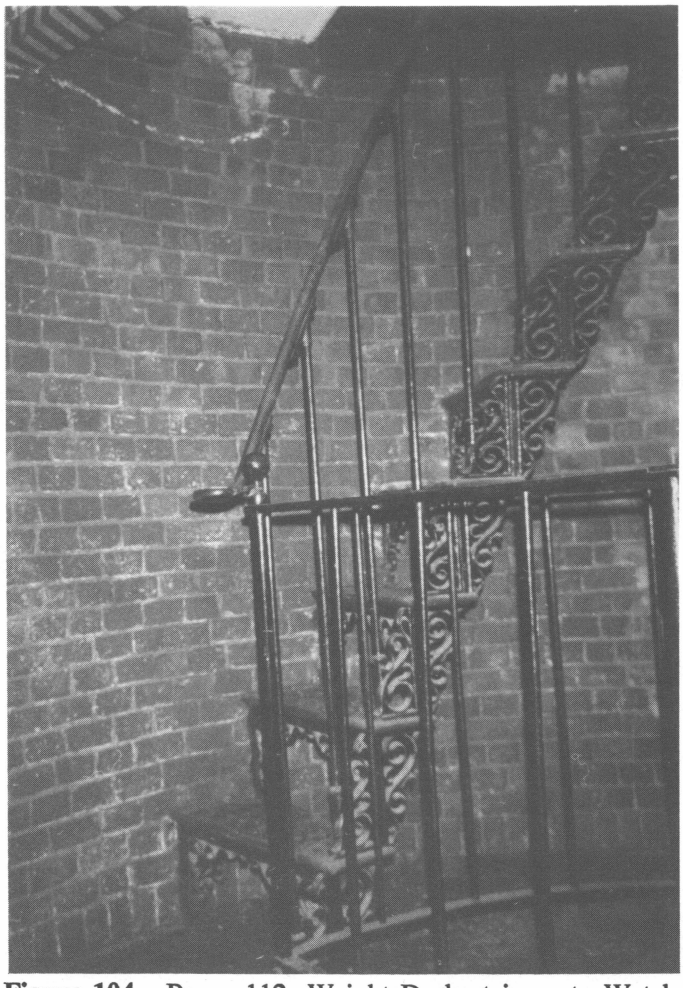


Figure 104. Room 112, Weight Deck stair up to Watch Deck.



Figure 105. Room 112, detail of tread of Weight Deck stair to Watch Deck.

Watch Deck

Floor

The floor consists of four steel plates with a circular plate at the center. The steel plates are bolted together through flanges at their seams. The floor is painted red. The diameter of the deck is approximately 11 feet. A pipe railing edges the opening in the floor for the stair down to the Weight Deck. This railing is painted black.

Walls

The walls are furred out with vertical wood tongue-and-groove boards that are 2 1/2 inches wide (fig. 106). A chair rail consisting of a plain strip of narrow molding divides the wall at a height of 3 feet 3 3/4 inches. Below the chair rail, the wall is painted black, while the wall above is painted white. At the location of the stair down to the Weight Deck, the wall has been recessed 4 1/2 inches to align with the face of the brick wall below.

Ceiling

The ceiling is formed by the underside of the steel-plate Lantern Deck above (fig. 107). The original perimeter-ring floor of the Lantern Deck is visible, which has since been covered by a circular flat steel plate to support the current light.

Doorways and Doors

A doorway to the Watch Gallery is located on the north side of the wall. The doorway opening is 2 feet wide by 5 feet 9 inches high. This doorway contains three doors. Innermost is a pair of four-panel wooden doors with black strap hinges at the top and bottom, and secured with a black bolt lock (fig. 108). The middle door (fig. 109) is a cast-iron door with an arched top, with a single arched panel in the center, painted white. This door is curved in plan to correspond to the curvature of the wall. The handle is a plain ring bolted through the door. A large hook and eye secures the door in a closed position; its hinges are three-knuckled. This door is painted white. The exterior door (fig. 110) is wood; the six vertical boards are held together with three horizontal battens bolted in place at the top and bottom with strap hinges. This door also has a rounded top and is painted white. Again, a simple ring is used as a handle with a hook and eye.

Window Openings

There are none.

Electrical Fixtures

A number of wires in gray conduit with black boxes (fig. 111) are located on the east side of the wall. Some of these devices control the main and emergency light signals. Others control

the intercom/telephone system, connected to the equipment room (Room 111) in the Tower Connector. A single-bulb fixture with a gray metal basket cover is also located on the east wall.

Stair

The open stair leading up to the Lantern Deck (fig. 112) is very steep and almost ladder-like. A short knotted rope hanging from the ceiling is used in place of a railing. There are eight treads; they are 4 1/4 inches at the wall side and taper to 3 1/4 inches at the inner side. They are of cast iron painted black. The furred-out wall is cut around the each tread, indicating that the wall was installed after the stair. The stair ascends to an opening in the floor of the Lantern Deck that measures 35 1/2 inches long along the outside curvature and 22 1/2 inches on the inside.

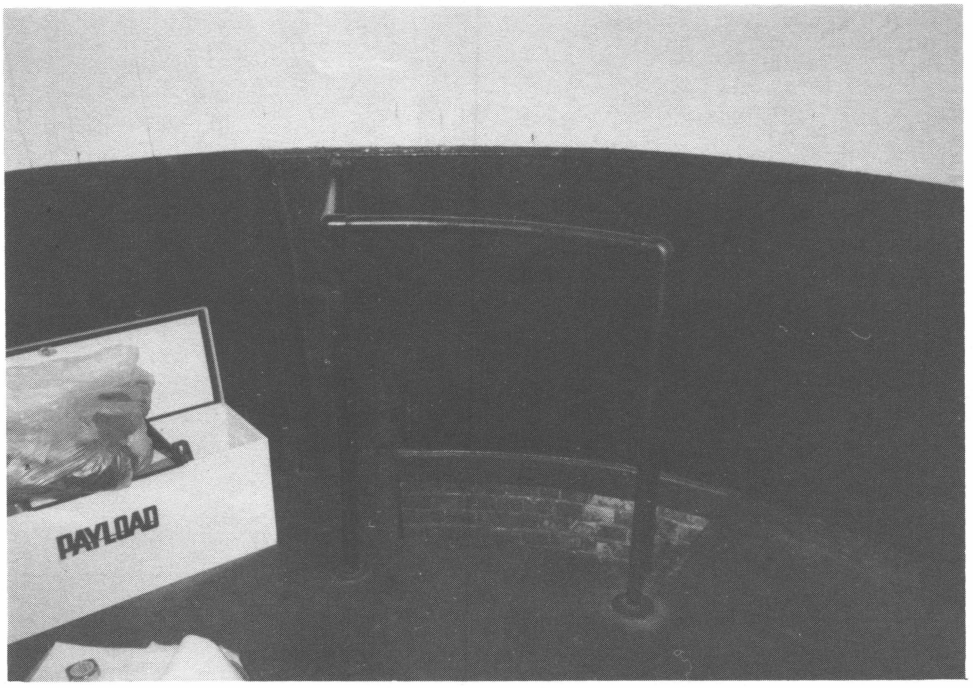


Figure 106. Room 112, furred-out tongue-and-groove wall of Watch Deck, with recess at stair opening down to Weight Deck.

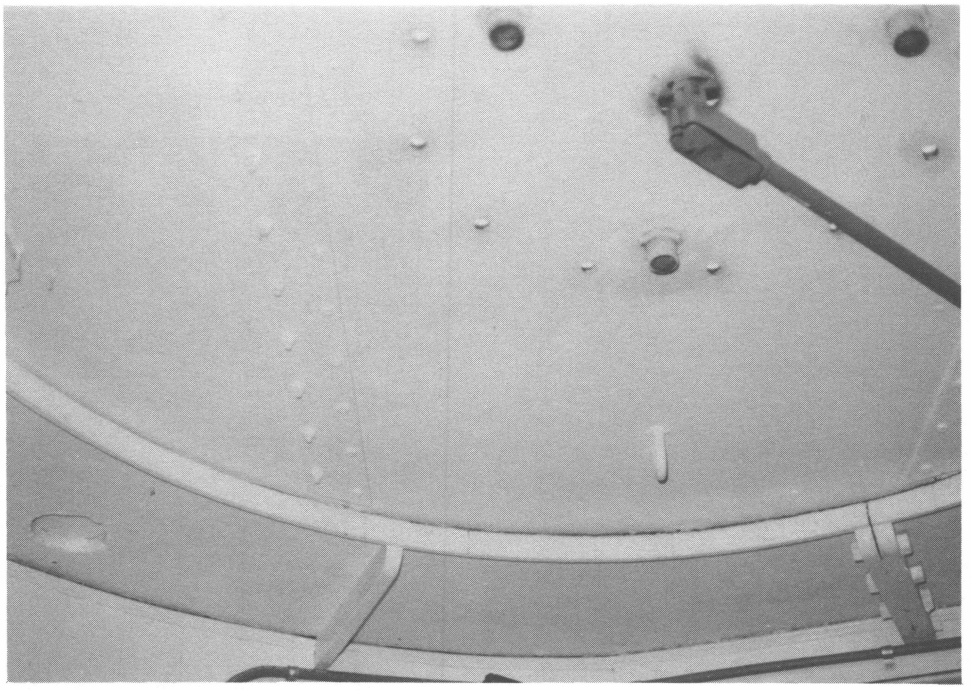


Figure 107. Room 112, Watch Deck ceiling (underside of Lantern Deck), showing original floor and later circular floor added to support 1946 beacon.



Figure 108. Room 112, innermost of three doors in exterior doorway from Watch Deck to Watch Gallery.

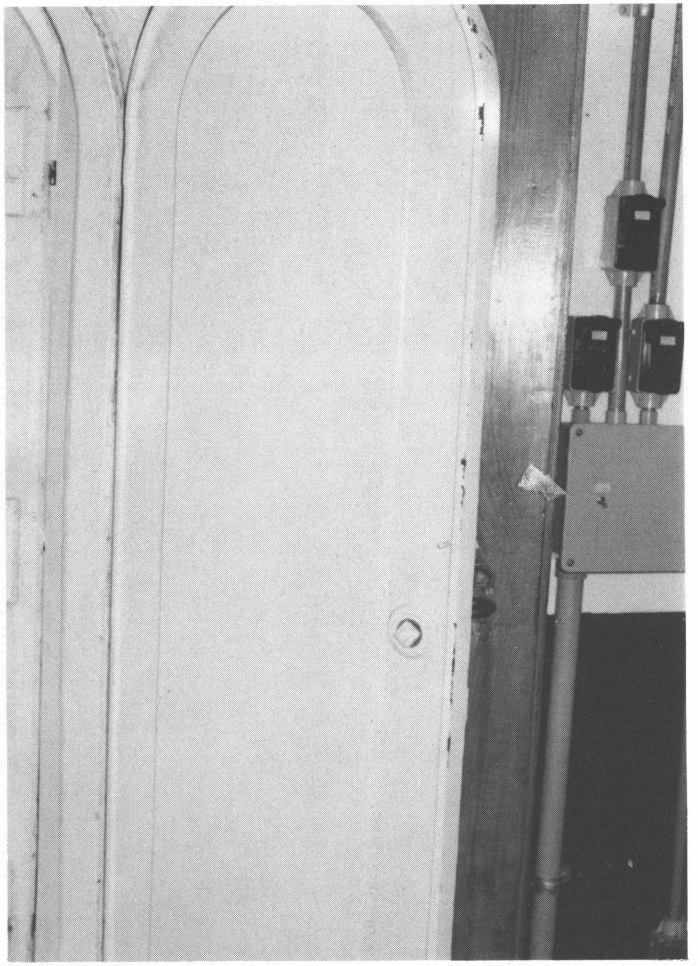


Figure 109. Room 112, middle door in exterior doorway from Watch Deck to Watch Gallery.



Figure 110. Room 112, outer door in exterior doorway from Watch Deck to Watch Gallery.

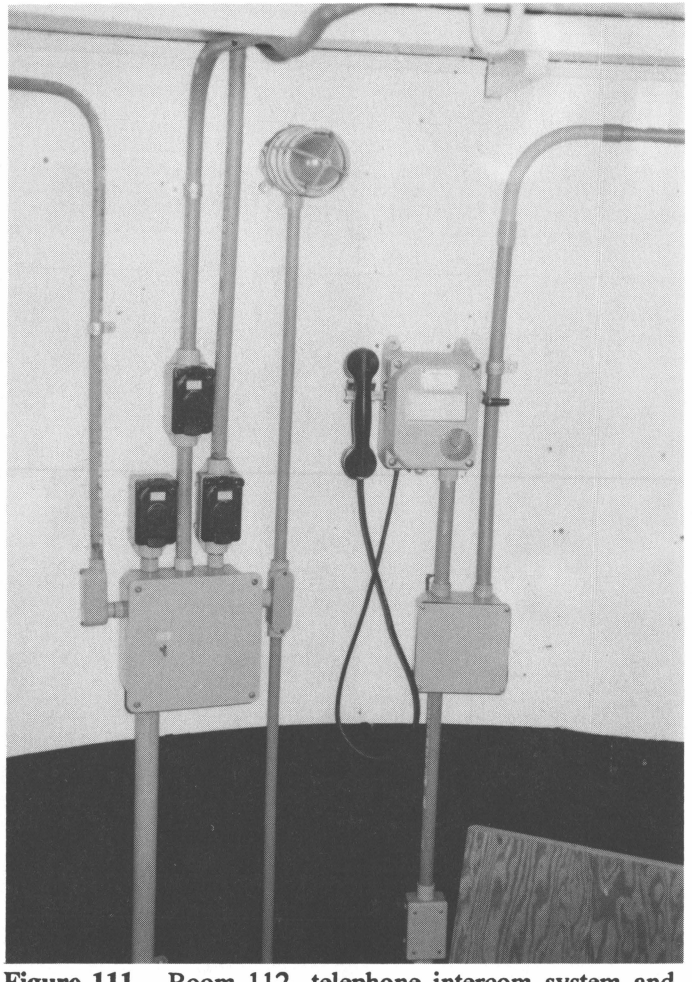


Figure 111. Room 112, telephone intercom system and electrical equipment on northeast wall of Watch Deck.

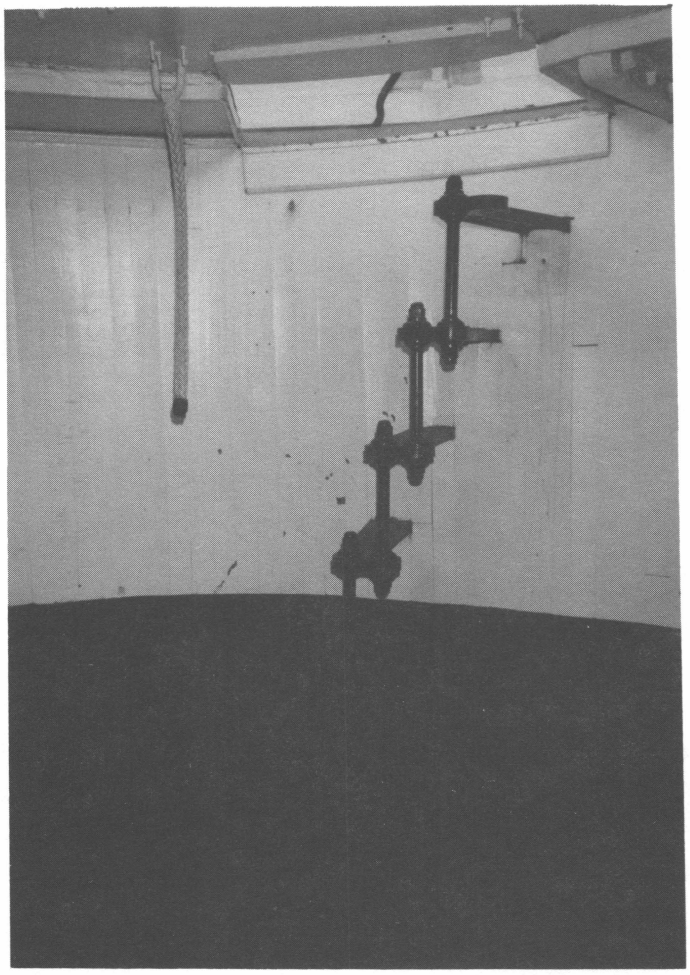


Figure 112. Room 112, stair on west wall of Watch Deck ascending to Lantern Deck.

Lantern Deck

The uppermost or Lantern Deck houses the light apparatus. The current beacon, a Crouse-Hinds DCB-224, was installed when the light was automated in 1987. (It replaced a Crouse-Hinds DCB-36 aerobeacon that had been in operation since 1946.) The light is contained in a revolving steel drum with plexiglass panels on either side. The light is unmanned and battery operated.

Floor

The floor of the Lantern Deck is covered with a circular steel floor in three sections. The original perimeter floor was presumably installed in 1857, and is visible from the Watch Deck below. It is composed of four sections of flanged steel plate, with intermediate stiffening webs, bolted together at the flanges (see fig. 107). A wood quarter-round base molding covers the junction of the floor and wall. The floor has a circular pattern of evenly spaced holes (fig. 113) near the center from previous equipment before the lantern was changed to a beacon in 1946. The floor is painted red. The opening in the floor for the stair down to the Watch Deck has been made narrower by the addition of a plywood section, 3 1/4 inches wide and painted yellow, along the inner side of the opening (fig. 114). On the opposite, outer edge of the opening, the top of the furred-out wall of the Watch Deck is painted bright yellow. A stock iron handrail protects the opening.

Walls/Windows

The "walls" of the Lantern consist of 16 panels of equal size rising from floor to ceiling. Each panel is divided into three horizontal sections. The sill of each panel is bolted to the floor, and intermediate horizontal mullions are bolted to the vertical members (fig. 115). The bottom sections of the panels measure 2 feet 7 1/2 inches high by 2 feet 1/2 inches wide, and consist of painted aluminum. Sheet-metal vent covers with filters are located at the base of each panel (fig. 116). The top two sections of each panel are filled with plexiglass; each measures 3 feet 4 3/8 inches high by 2 feet 1/2 inches wide. The tops of the panels form a continuous iron ring (fig. 117). A vent is centered above each panel. Iron pegs (fig. 118) pin the vertical mullions to the perimeter lintel. Attached to these blocks are eye hooks and eye bolts that may have been used for curtains. All of the metal is painted white.

Ceiling

The ceiling is covered with sections of sheet metal that are painted white, the underside of the truncated cone spaced several inches below the underside of the roof. The lantern lining was replaced in 1906. The sheet metal is secured with bolts of alternating size. At the center of the ceiling, a circle is cut out for a ventilator (fig. 119).

Doorways and Doors

The only doorway is the opening in the floor for the ladder down to the Watch Deck.

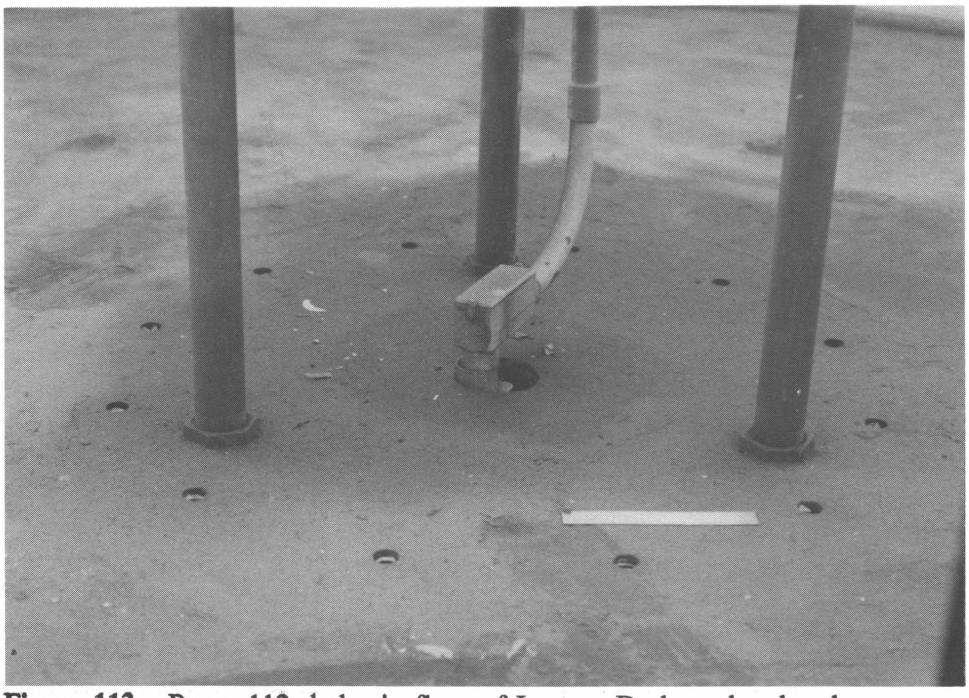


Figure 113. Room 112, holes in floor of Lantern Deck made when beacon was replaced in 1946.

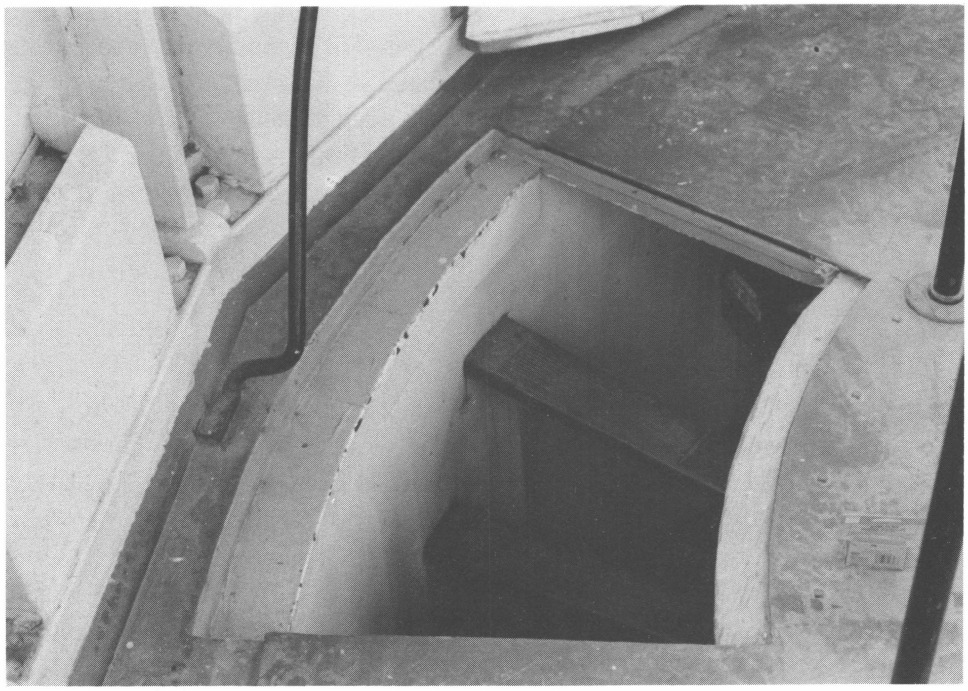


Figure 114. Room 112, opening at west side of Lantern Deck floor for stair down to Watch Deck.



Figure 115. Room 112, horizontal mullion of Lantern Deck window wall.

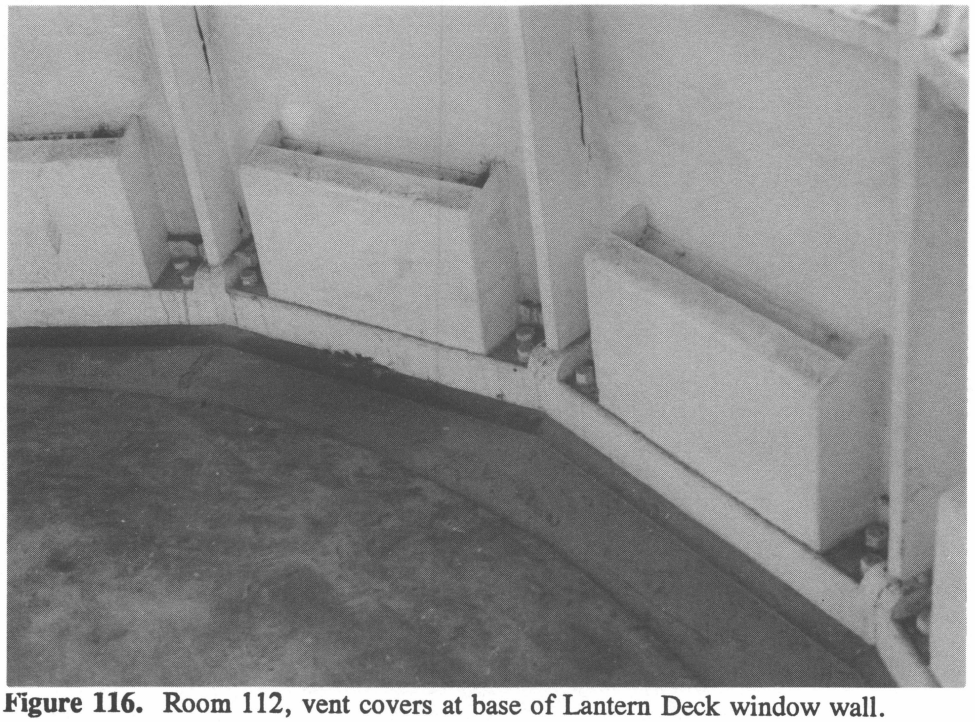


Figure 116. Room 112, vent covers at base of Lantern Deck window wall.

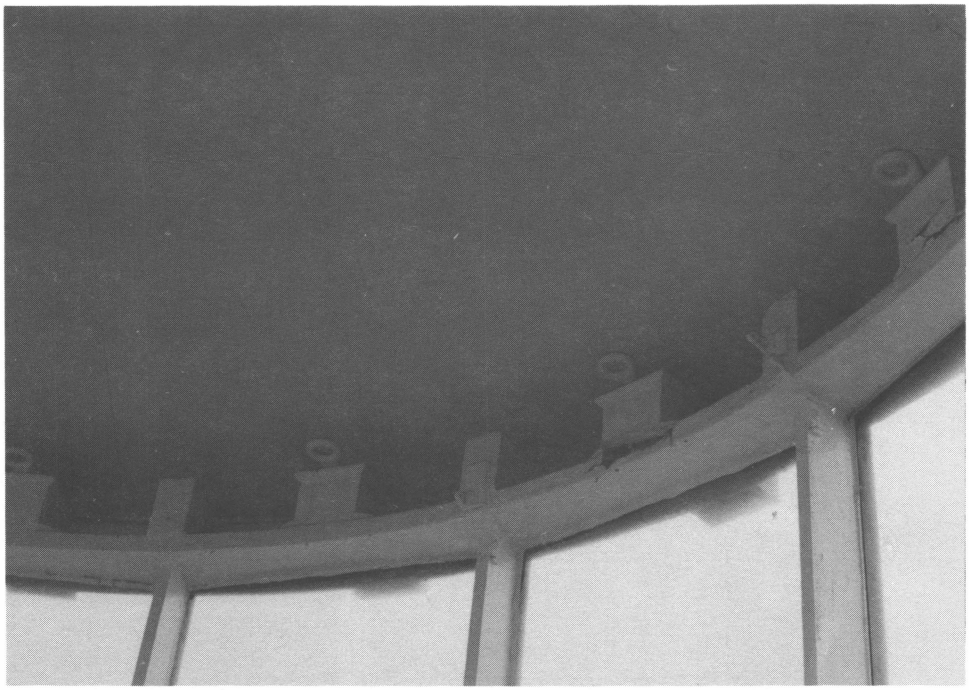


Figure 117. Room 112, ventilation boxes at top of Lantern Deck window wall.

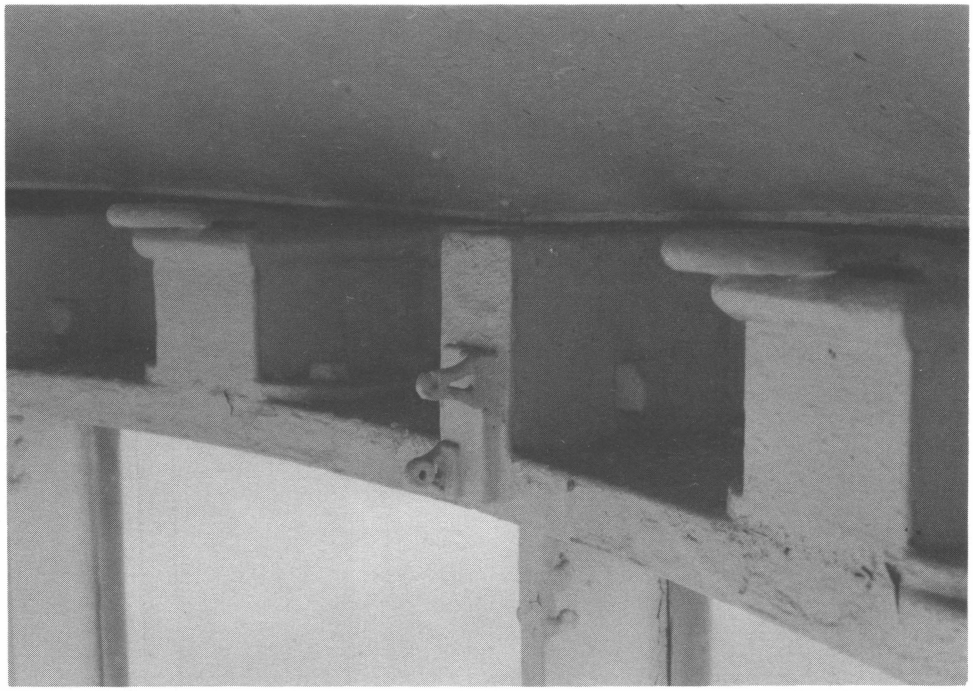


Figure 118. Room 112, iron pegs that pin vertical mullions of Lantern Deck windows to continuous perimeter lintel. (Note curtain hooks.)

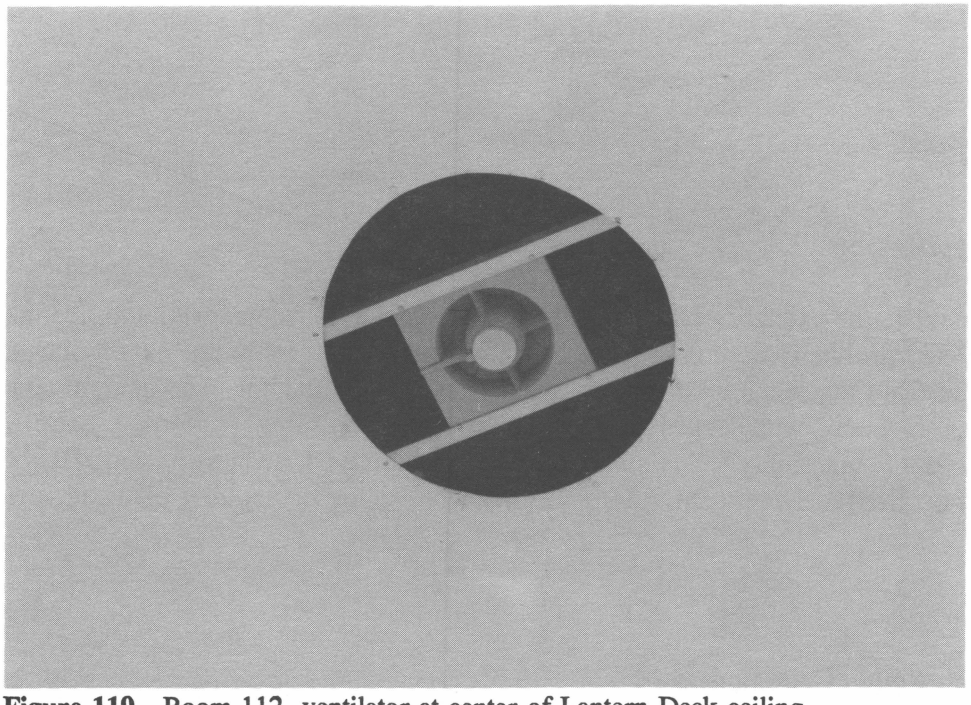


Figure 119. Room 112, ventilator at center of Lantern Deck ceiling.

CONDITIONS ASSESSMENT AND REPAIR RECOMMENDATIONS

[Note: The preceeding descriptive sections of this report dealt first with all of the structures' exterior features, and then with all of their interior ones. However, this section discusses each structure one at a time, examining first the exterior and then the interior conditions. It was thought that this approach would most clearly demonstrate the relationship between the structures' exterior deficiencies and interior deterioration.]

Keeper's Dwelling

Exterior Elements

General Information

Generally, the exterior of the Keeper's Dwelling is in fair condition, with the majority of the moisture-related problems stemming from a lack of downspouts (only one extant out of eight total). Water exiting from the open gutter outlets saturates the wood siding. The general condition of the lead flashing is poor, with improper installation and/or missing sections. Lack of consistent maintenance has resulted in various minor open joint conditions, such as missing flashing, unsealed seams, split or cracked wood trim, and/or insufficient sealing or painting of wood surfaces.

Roofs

Porch Roof - Conditions

- Most of the lead flashing is cracked, with missing sections of flashing where the porch roof connects to the north elevation of the main structure (fig. 120 and 121).
- The asphalt shingles are alligatored (deteriorated), with the shingle substrate visible through the cracks.
- The gutters empty directly onto the porch roof (without elbows or downspouts).
- The condition of the nailed metal flashing at the ends of the wooden built-in gutters appears to be improperly installed.
- The unfinished interior surfaces of the wood gutters exhibit cracking/splitting (fig. 122).

Main Roof and Ell Roof - Conditions

Access to the upper portion of the roof was not possible, but conditions there appear to parallel the condition of the porch roof.

- The ends of the wooden built-in gutters are not flashed in a neat manner where they meet the eave trim and roof, inviting situations of accelerated moisture penetration and deterioration.

Dormers - Conditions

- There is inconsistent metal flashing at the roof-to-dormer wall junctures, permitting moisture to penetrate the end grain of the corner boards and wood shingles (fig. 123). The missing flashing provides pockets where sand has collected, further aggravating deterioration by maintaining moist conditions.
- There are multiple layers of roofing from previous roofing campaigns visible at the roof edge.
- There is absorption of moisture by the end grain of the wood roof shingles below the asphalt shingles at the bottom edge of the roof. (These shingles are either part of an earlier wood-shingle roof, or a starter course for the asphalt shingles.) The absorption is due in part to the lack of a drip edge.
- Green biological growth is visible at the lower edge of the wood-shingle siding of the west dormer's side walls, due to its proximity to the roof surface.

All Roofs - Recommendations

- Install metal drip edges at all eaves in future roof replacement.
- Install proper and complete flashing at all wall-to-roof junctures.
- Future roof work should include consideration of attic venting.
- Verify condition of flashing at termination of built-in gutters to roof edges.
- Treat the inside of gutters with wood preservative.
- Install leaders, downspouts, elbows, and splash blocks at all gutter outlets.
- Replace asphalt shingles.
- Cut back wood shingles at sides of dormers 1 inch from plane of roof and install metal flashing at roof-to-dormer juncture.
- During reroofing, remove all layers of previous asphalt roofing shingles.

Chimneys

Conditions

- The central chimney appears to have a damaged cap, with deteriorated and painted-over flashing.

Recommendations

- Repair the cap of the central chimney.
- Install new step flashing at both chimneys.
- Verify the condition of chimney flues.

Walls

South Elevation - Conditions

- There is a hole in the siding (approx. 2 inches in diameter) with a missing wood shingle adjacent to the east elevation of the connector.
- There are miscellaneous wires; one may possibly be the ground wire for the lightning rod

South Elevation - Recommendations

- Plug the hole in the wood siding.
- Verify the connection of the lightning rod's ground cable.
- Remove superfluous wires and patch holes.
- Remove miscellaneous eye bolts and other fittings not required.

West Elevation - Conditions

- Miscellaneous fittings include a dryer vent and hose bib.
- The downspout at the north end is missing.
- The downspout at the south end empties directly onto grade without a diverting elbow.
- The corner board and wood siding at the northwest corner appear to have been chewed by an animal.
- The basement window sills are deteriorated.
- Due to the lack of a downspout at the north section of the gutter, water is soaking a large portion of the wood siding below the gutter (fig. 124).
- At the eave cut-out (in line with the sill of the second-story window), water is saturating the wood siding. This is partly due to the shallow eave, and water running off the short section of roof edge adjacent to the window jamb.
- The ends of the corner boards, which are close to the roof surface, are splitting from end-grain absorption of moisture.
- The porch is supported by irregularly spaced wood posts, which are supplemented by stacked concrete masonry units adjacent to the wood posts.
- Wood trim is deteriorated, especially at the porch column bases.
- Replacement wood trim at the porch column bases and caps does not match the circa-1930's material in profile and dimension.
- There is a conglomeration of wood steps leading from the porch to the ground, varying in width and height.

West Elevation - Recommendations

- Install leaders, downspouts, elbows, and splash blocks.
- Properly treat the end grain of all wood trim likely to absorb moisture.
- Paint the posts and latticework at the base of the porch to match the house foundation.
- Verify the structural integrity of the porch's support structure.
- Repair and replace the wood trim of the porch columns to match its circa-1930's appearance in profile and dimension.
- Relocate steps from the north elevation to the west elevation to match the circa-1930's appearance.

North Elevation - Conditions

- The lead flashing below the ell window has failed, partly due to improper patching (fig. 120). The metal flashing is trough-shaped and has several holes, which collects water and allows it to penetrate to the interior of the roof structure. This has presumably caused the staining and attendant dark mold on the ceiling of the north vestibule below the window.
- An open joint between the gable end trim where it passes over the ell window's head trim may be admitting moisture.

North Elevation - Recommendations

- Replace all failed flashing.
- Seal the open joint between the gable end trim and the north window's head trim.

East Elevation - Conditions

- All downspouts are missing.
- The grade is built up against the bottom of the wood siding and over the sill of the basement window (figs. 125 and 126).
- The sill of the entry door drops at the east end.
- There is damaged/deteriorated wood trim at the edge of the entry roof.
- The step flashing is improperly installed over the asphalt roof shingles at the entry.

East Elevation - Recommendations

- Install leaders, downspouts, elbows, and splash blocks at both gutter sections.
- Verify the condition of the flashing at the termination of the built-in gutters.
- Scrape and paint the metal vent stack.
- Regrade surrounding soil to a minimum of 6 inches below the bottom of the wood siding, where possible, sloping away from the building.
- Regrade soil to a level below the basement window sill.
- Install a proper scupper at the valley of the interconnected dormer roofs.
- Reset the sill of the entry door sill in a level condition.
- Replace all step flashing.
- Repair/replace deteriorated wood trim.

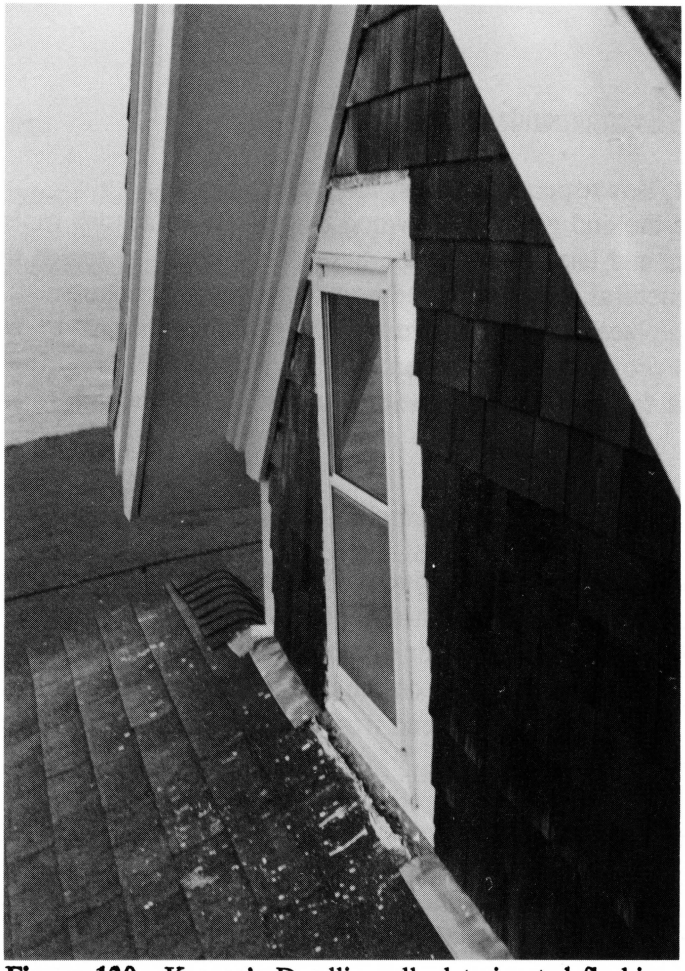


Figure 120. Keeper's Dwelling ell, deteriorated flashing at north elevation.

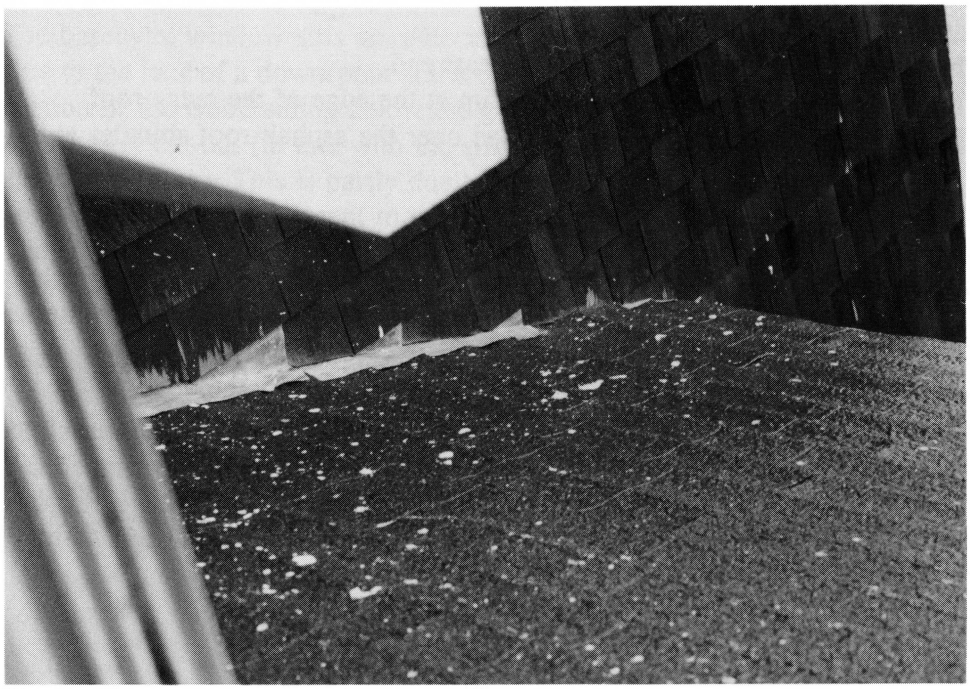


Figure 121. Keeper's Dwelling, juncture of porch roof and north wall.



Figure 122. Keeper's Dwelling roof, north end of west elevation.



Figure 123. Keeper's Dwelling ell, north side of west dormer.



Figure 124. Keeper's Dwelling, water staining at west elevation.

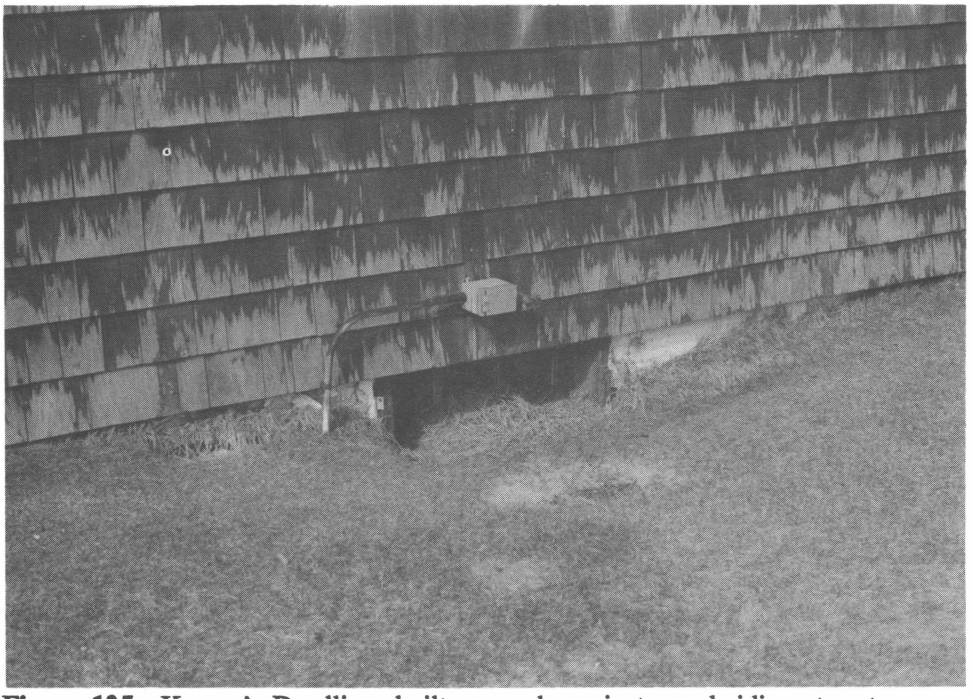


Figure 125. Keeper's Dwelling, built-up grade against wood siding at east elevation.



Figure 126. Keeper's Dwelling, built-up grade against wood siding of east elevation.

Interior Elements

General Information

The interior wall and ceiling surfaces of the Keeper's Dwelling are contemporary and in good condition. Sand is being windblown around the window frames on all elevations, occasionally creating a damming effect at the sill, preventing water to drain out (fig. 127).

Basement

Conditions

- There is a leak from holes in the corroded metal bulkhead, especially at the juncture of the bulkhead and the wall.
- Water is seeping into the basement approx. 18 inches above the floor, through brick joints behind the sink on the east wall, and ponding at the low point against the cistern wall (figs. 128 and 129).
- Water is also entering from the 4 1/2-inch metal pipe set in the east wall approx. 12 inches above the floor, which contains water supply pipes for the hot-water heater.
- There are eroded mortar joints and separating brick units in the masonry wall at the north side of the west foundation wall (fig. 130).
- Orange staining is running from the chimney flue opening onto the parged chimney surface.
- The wood cellar sashes and frames are deteriorated.

Recommendations

- Determine the source of the moisture penetration along the east wall.
- Regrade and/or damp-proof the bulkhead retaining walls.
- Install a new bulkhead with proper seal/flashing.
- Rebuild the damaged walls and repoint deteriorated mortar joints.
- Rebuild the cellar sashes with storm panels, and screened panels to ventilate the basement during the summer.



Figure 127. Keeper's Dwelling, typical interior window sill with wind-blown sand.

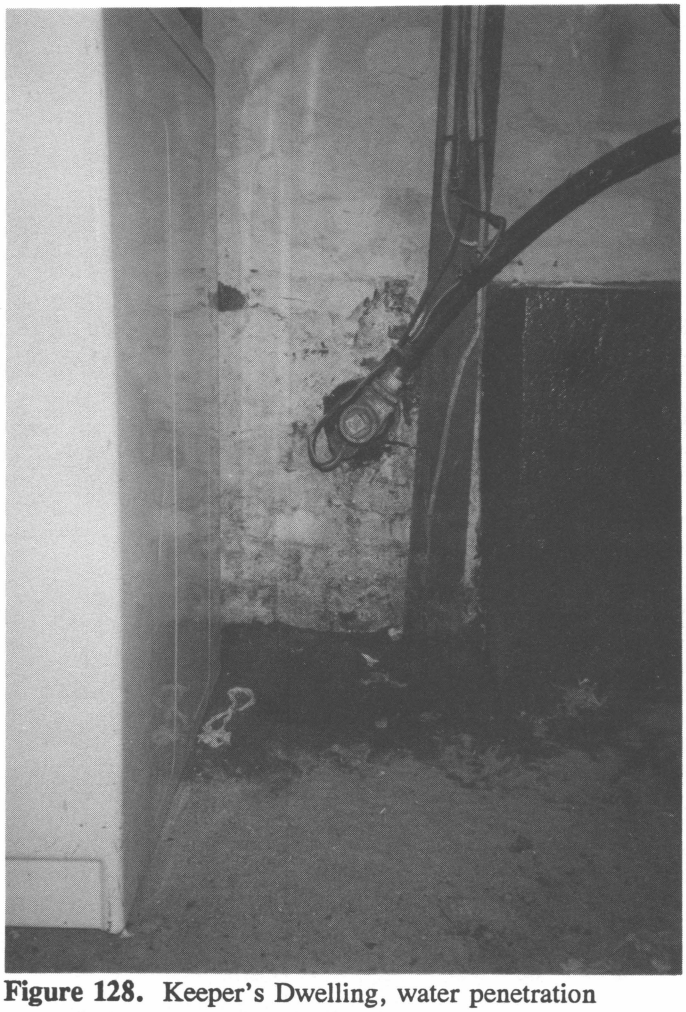


Figure 128. Keeper's Dwelling, water penetration around pipes at east wall of basement.

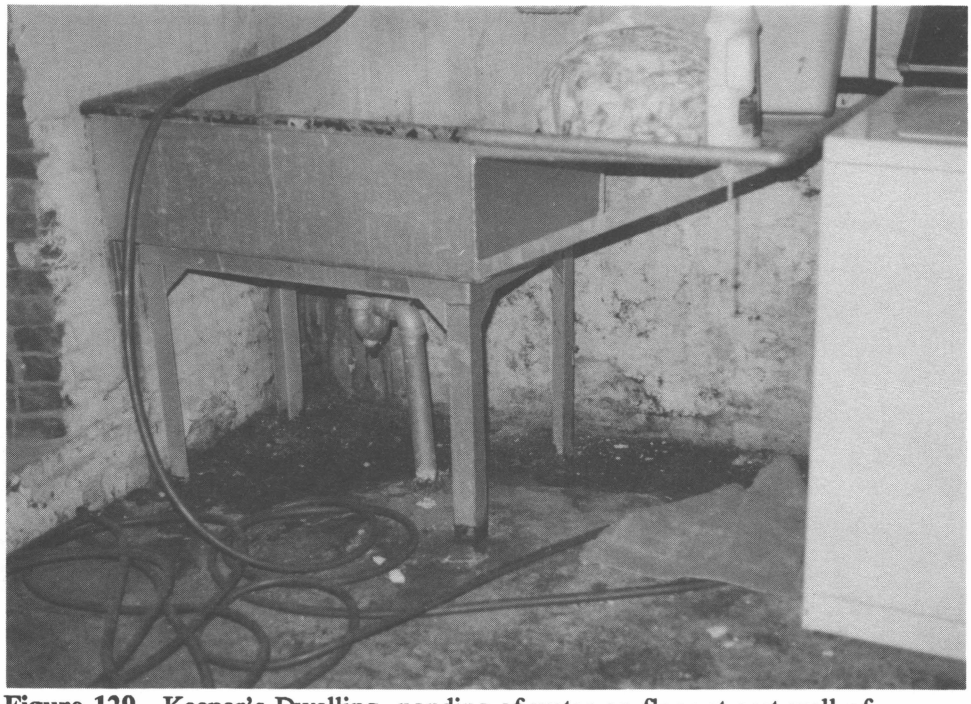


Figure 129. Keeper's Dwelling, ponding of water on floor at east wall of basement.

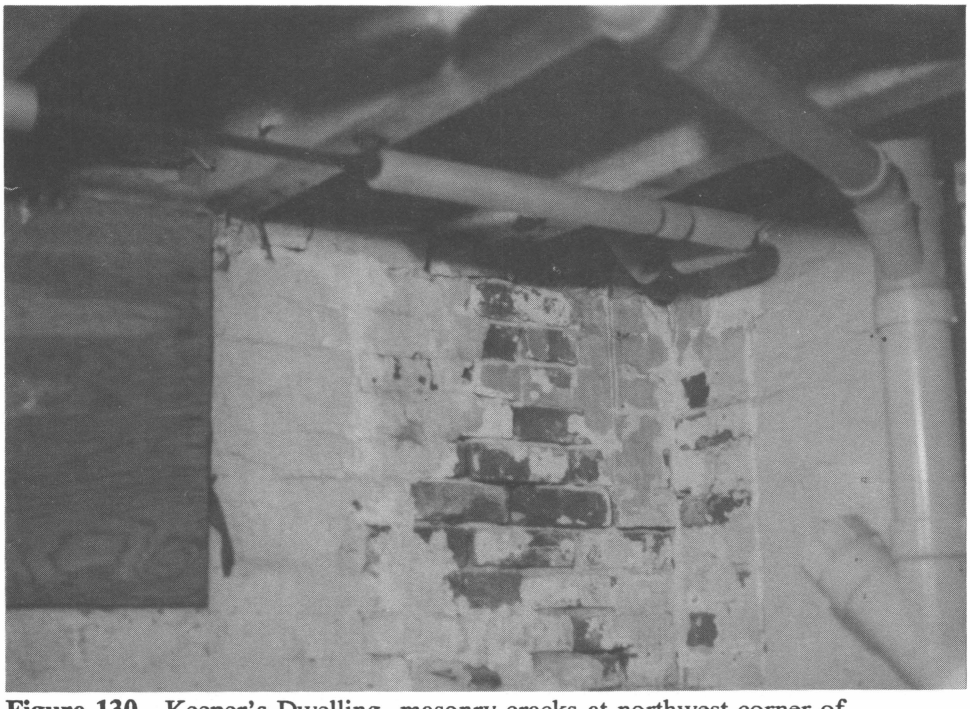


Figure 130. Keeper's Dwelling, masonry cracks at northwest corner of basement.

First Story - North Vestibule

Conditions

- A dark mold growth exists above the kitchen doorway to the north vestibule, and above the north vestibule's doorway to the porch. It is presumably due to the failed flashing at the roof-to-wall juncture below the ell's second-story north window. There is also mold on the wall between the kitchen and porch doorways.

Recommendations

- Repair flashing as per exterior recommendations.

First Story - Southeast Room

Conditions

- A water stain is visible from a previous leak in the bathroom above. (As reported by the current tenant, windblown sand had clogged the window sill, allowing water to flow into the bathroom).

Recommendations

- Monitor sand accumulation and remove periodically.

Attic

Conditions

- There is evidence of previous leaks at the chimney (on top of the insulation), especially on the east and west sides. Daylight is visible at the east side of the chimney, due to a lack of exterior metal flashing there. (The only flashing at that location appears to be the cementitious coating seen on the other sides of the chimney.) Brick dust is visible on the insulation at the north side.
- Burrow-like holes (approx. three-quarters of an inch in diameter) in the rock wool insulation appear to have been made by animals or insects.

Recommendations

- Investigate the cause of the holes in the attic insulation to determine if there is a need for pest control.
- Install new chimney flashing.

Connector at the Keeper's Dwelling

Exterior Elements

Roof

Conditions

- The flashing where the connector roof meets the south elevation of the Keeper's Dwelling is questionable.

Recommendations

- During the next scheduled roof work, all flashing should be replaced.

East Elevation

Conditions

- All downspouts, elbows, and brackets are missing at the east side.
- The metal flashing is loose at the inside of the wood gutter outlet tubes and gutter ends (fig. 131).
- The wood trim at the bottom of the blocked doorway is deteriorated.
- The building joint between the connector and the Keeper's Dwelling has been covered with an undetermined material and painted over, which has not been able to accommodate differential movement between the two structures.

Recommendations

- Replace all downspouts and associated hardware.
- Install a proper building joint with backer rod and sealant to allow differential movement between the structures.

West Elevation

Conditions

- The two downspouts on the north elevation of the Tower Connector empty directly onto the ground adjacent to the Connector at the Keeper's Dwelling.
- There is evidence of corrosion from the nails through the paint at the wood trim along the eave.

Recommendations

- Regrade to provide positive drainage from the base of walls and blocked entry doors.
- Install leader, downspout, elbow, and splash block at the south end of gutter.
- Consider combining the two downspouts between the Connector at the Keeper's Dwelling and the Tower Connector.
- Install proper flashing where the gutter meets the roof edge.
- Install a proper building joint between the connector and Keeper's Dwelling using a backer rod and sealant.
- Use only noncorroding fasteners, such as galvanized or stainless steel nails.



Figure 131. Connector at Keeper's Dwelling, east elevation, south end of built-in roof gutter.



Figure 132. Connector at Keeper's Dwelling, built-in wood gutter at east elevation.

Tower Connector

Exterior Elements

West Elevation

Conditions

- There is no visible cracking or spalling of the white cementitious wash over the brick, which appears to have been recently resurfaced.
- The condition of the metal flashing at the built-in gutter end (by the entry roof) is questionable (fig. 132).

North Elevation

Conditions

- The wood trim at the gable end has peeling paint, with wood sheathing visible behind missing flashing. The flashing is painted over where the Connector at the Keeper's Dwelling intersects the north wall of the Tower Connector.

East Elevation

Conditions

- Paint is peeling from the wood gutters, whose interiors are unfinished, with large splits and cracking.
- The condition of the flashing at the termination of the built-in wood gutters is questionable (it is heavily painted over).
- All downspouts, brackets, elbows, and splash blocks are missing.
- The place where the wooden eave trim meets the Tower wall may be deteriorating due to end-grain absorption of moisture.

Recommendations

- Repair/replace the asphalt-shingle roof.
- Install downspouts and associated flashing.
- Install flashing at all roof-to-wall and roof-to-roof junctures, keeping the end grain of wood trim clear of wetted surfaces.
- Repair the ends of the wood gutter at its intersection with the entry roof.
- Install metal drip edges to keep water away from wood trim.

Interior Elements

Conditions

- Brown staining indicative of several leaks is evident on the acoustical-tile ceiling, especially over the doorway between the Equipment Room and the connector.

Recommendations

- Monitor the leak(s) at the ceiling to determine if they are active.

Tower

Exterior Elements

Shaft

General Conditions

The proximity of the lighthouse to the ocean presents one set of adverse conditions, which are further aggravated by the lighthouse's position on the edge of a bluff. The force of the wind increases proportionally to the height above water or land. Predictably, the east elevation facing the ocean displays a weathered condition distinct from the other elevations, despite the circular plan of the tower. The tower has received a number of cementitious coatings in its history. Presently, the conditions of the west, north, and south elevations are such that there is little evidence of failed surface coating, or spalling or cracking of brick. In contrast, the east elevation reveals minor cracking of the brick and/or coating, peeling/flaking paint, and several areas of brick spalling.

The accelerated weathering of the eastern, ocean side is graphically illustrated by the Lantern Deck windows. The circular plan is divided into 16 even sections, with polycarbonate glass filling the top two horizontal sections of each division. The four windows facing most easterly are severely pitted by the effect of windblown sand, salt, and other debris, while the two adjacent windows on either side are noticeably less pitted. The remaining 10 windows are fairly clear.

Orange staining is evident on the white face of the tower wall from corrosion emanating from the Watch Deck, especially east of the Weight Deck window, but also at several areas at the perimeter of the tower. It was impossible to determine the exact source of the problem due to limitations of visual access at the curved underside of the Watch Deck. The staining may be from water running from the metal deck and/or fittings above. Alternatively, there may be metal pins and/or fasteners associated with the granite deck sections that are corroding.

The surface coating on the exterior limits the inspection of the exterior mortar joints. However, these mortar joints generally appear to be in fair to good condition.

Over time, the grade has built up against the structures. The moving and relocation of the Light Station will provide the opportunity to correct this problem and minimize water infiltration from the ground. At the new site, the structures should be placed on full foundations to limit the moisture-related problems of ground-water infiltration, and to allow the venting of crawl spaces. There should be the minimum amount of grade possible against the exterior walls.

Two copper-weave lightning-rod cables are attached to the east and west elevations; they extend from the roof to grade. It is unclear if the orange staining adjacent to the west cable is a result of corroding iron fittings associated with the cable attachment to the Tower.

General Recommendations

- Regrade surrounding soil to create positive drainage.
- Perform a thorough cleaning of metal elements to remove all corrosion prior to painting.
- Monitor brick deterioration over time.
- Selectively replace deteriorated masonry units.

East Elevation - Conditions

- The east side of the tower (figs. 133-136) exhibits the most severe brick deterioration, with fine cracking of the outer surface-applied coating, and spalled brick faces. Considering the saturated interior wall, freeze-thaw cycles are probably contributing to the deterioration of the brick. The damage is accelerated by the transportation of salt by windblown spray. The ground below the east elevation is littered with brick and fragments of paint and/or cementitious coatings, indicating that the deterioration process is active.

South Elevation - Conditions

- There are two spalled brick ends below each window (figs. 137 and 138).

South Elevation - Recommendations

- Replace/consolidate spalled bricks and recoat them.
- Provide a more controlled means of ventilation to allow drying out of the interior after periods of high humidity.
- Use of a waterproof coating should be considered only if the problem persists after all other remedial and repair work is completed.

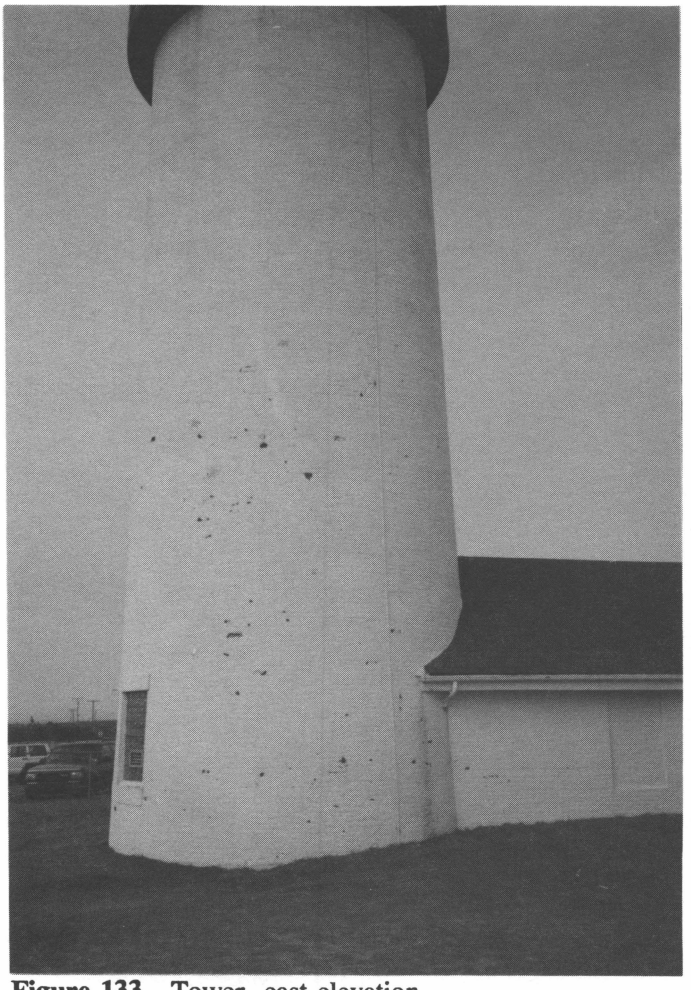


Figure 133. Tower, east elevation.

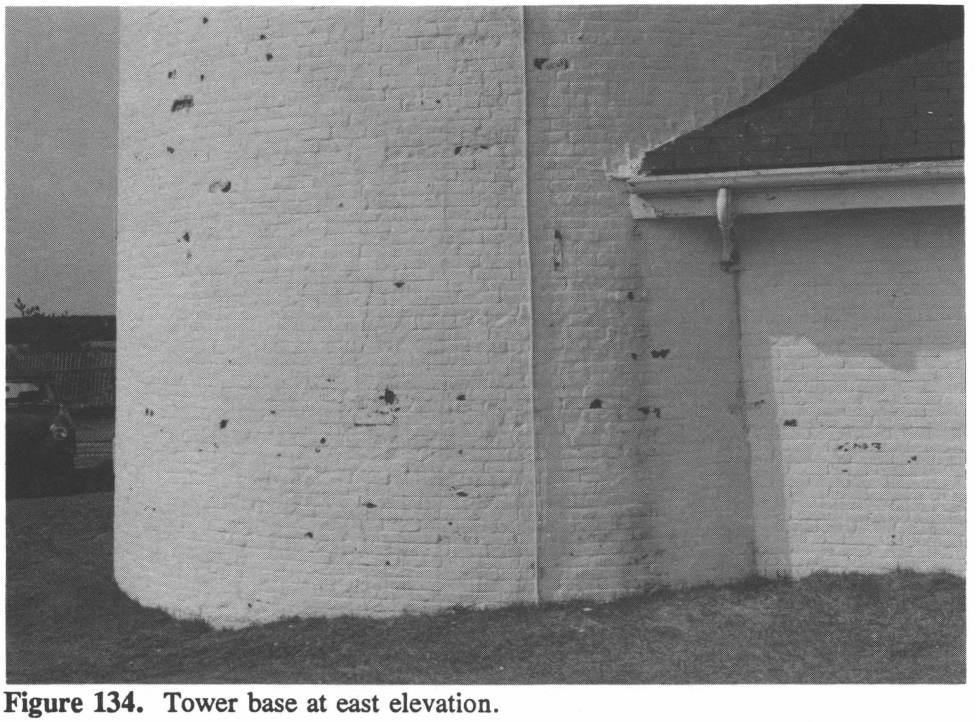


Figure 134. Tower base at east elevation.

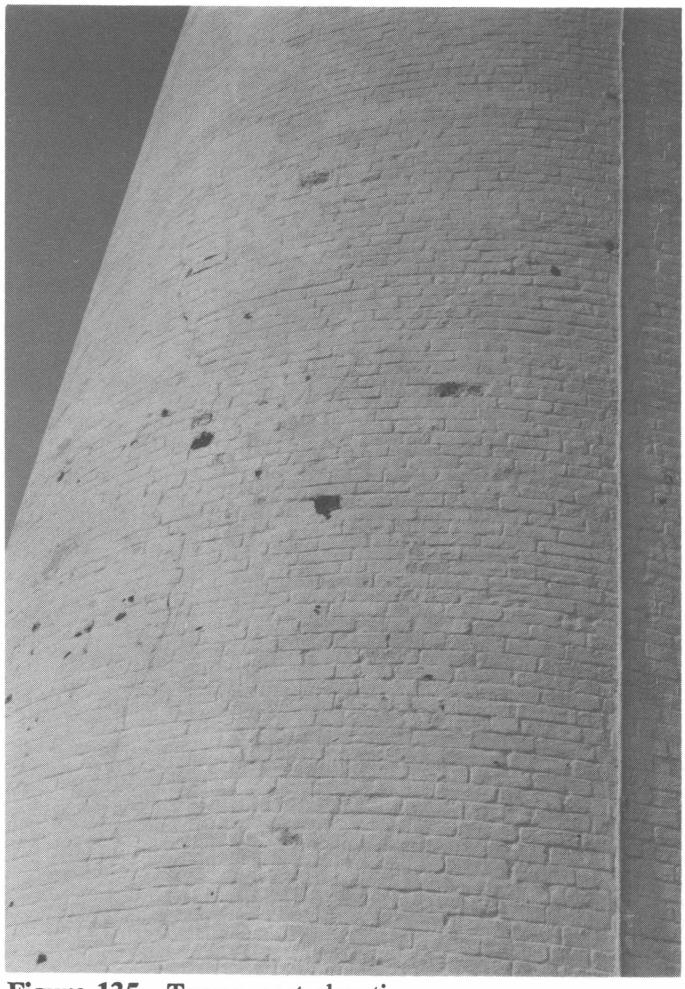


Figure 135. Tower, east elevation.

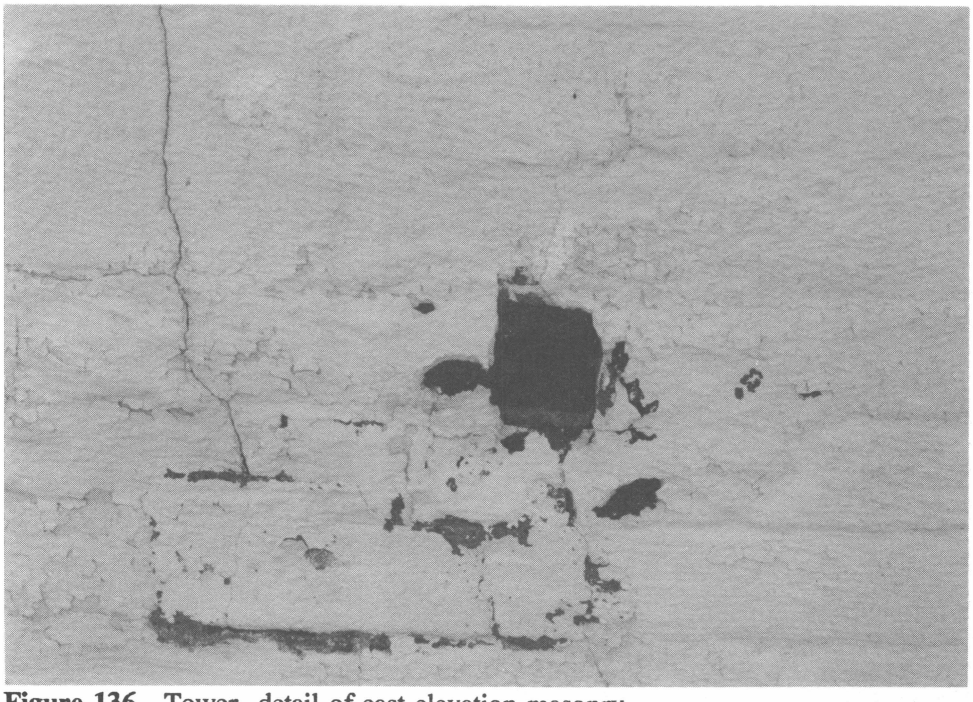


Figure 136. Tower, detail of east-elevation masonry.

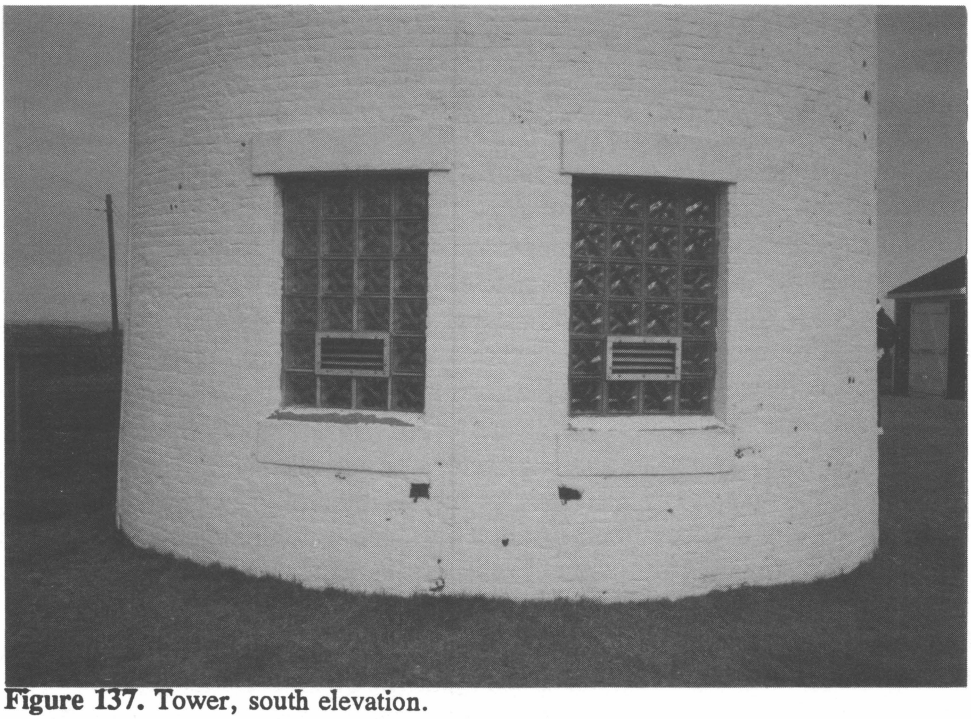


Figure 137. Tower, south elevation.

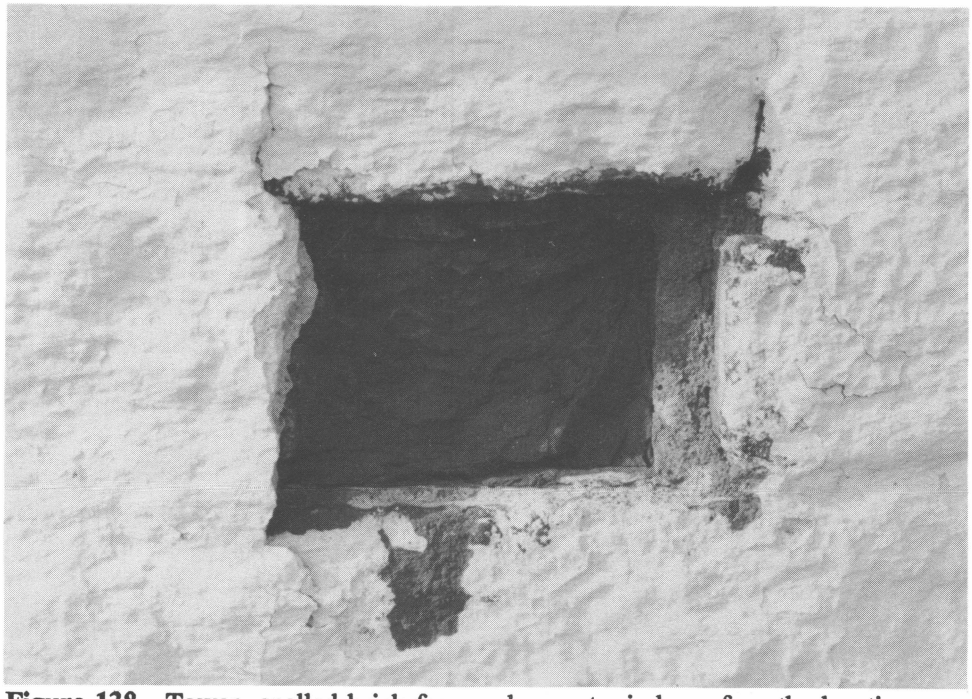


Figure 138. Tower, spalled brick face under west window of south elevation.

Watch Gallery

Conditions

- The floor of the gallery is composed of 15 granite sections, sloping to the exterior, with strips of lead sheet over the joints (fig. 139).
- Sealant runs intermittently at a joint in the brick wall (located one course above the granite floor) where the edge of metal is visible, perhaps from through-wall flashing.
- Eight metal tie rods are anchored in the granite by a rectangular metal plate welded to the end of each rod, with two metal anchor studs retaining the plate in the granite. The top of the rod is threaded and bolted with a hexagonal nut after passing through the metal Lantern Gallery. Several bolts are corroding from water entering the break in paint layer between bolt and gallery. One rod is completely detached from the granite, with the anchors being completely corroded. Several other plates (east and south) have been relocated 90 degrees from their original orientation, with two contemporary anchor bolts reattaching the plates from above to the granite. Presumably, these plates had become detached.
- Some of the granite floor sections (fig. 140) are not level with adjacent sections (e.g., the section under the south end of the ladder to the Lantern Gallery).
- The hinges of the exterior door in the doorway to the Watch Deck exhibit corrosion due to the wearing of paint surface coatings (figs. 141 and 142).
- The Watch Gallery railing appears to be original. Consisting of eight sections, it has flat metal handrails and bottom rails, and round metal balusters. The amount of corrosion visible is consonant with the severity of the location.

Recommendations

- Monitor the granite floor sections for movement.
- Verify the condition of the flashing at the granite joints, and at the juncture of the granite floor and the brick Tower wall.
- Apply sealant to open joints where metal wall flashing is seen.
- Grease exterior hinges to prevent corrosion at points of metal-to-metal contact.



Figure 139. Tower, granite floor of Watch Gallery.



Figure 140. Tower, shifted granite section of Watch Gallery floor.



Figure 141. Tower, head of doorway from Watch Gallery into Watch Deck.



Figure 142. Tower, sill of doorway from Watch Gallery into Watch Deck.

Lantern and Lantern Gallery

Lantern - Conditions

- There is extensive through corrosion at two southeast metal vent covers (fig. 143).
- A metal cable and turnbuckle act as a tension ring at the circumference of the Lantern window head. Its necessity is not obvious.

Lantern - Recommendations

- Remove the corroded sheet-metal vent covers; weld in new sections, matching the dimension and thickness of the originals, and repaint.
- Determine the structural necessity of the cable and turnbuckle, and remove if not required.

Lantern Gallery - Conditions

- The floor of the Lantern Gallery (fig. 144) is composed of four sections of flanged one-inch steel plate with intermediate stiffening flanges corresponding to the 16 Lantern divisions. The sections are bolted together at the flanges.
- Drainage appears to be handled by two holes in the floor, emptying onto the Watch Gallery below.
- Nine holes in a circular configuration are drilled in the metal floor on the east side, with active corrosion on the insides of the holes.
- A metal eye is cantilevered over the southeast side, held by two straps bolted to the deck (fig. 145).
- There is corrosion at several of the metal bolts on the threaded metal tie rods that extend to the granite Watch Gallery floor below. The southeast tie rod is completely detached at the bottom plate.
- The existing railing of the Lantern Gallery is a modern pipe rail with aluminum fittings. It consists of 16 section, corresponding to the 16 divisions of the Lantern. The railing has an intermediate horizontal rail; this differs from the original design, which had only a top rail. The contemporary railing is not in character with the original railing in either design, materials, or proportion.

Lantern Gallery - Recommendations

- Repair the deteriorated metal tie rod by welding a new threaded section to existing, and add a new bolt as required. Provide a flexible means of sealing the joints between bolt, rod, and metal deck.
- Consider the future replacement of the non-historic aluminum handrail with a painted metal railing matching the original in configuration and dimension.
- Remove corrosion at miscellaneous holes in the metal deck and paint with appropriate metal primer and finish coats.
- As much as possible, avoid the use of incompatible brackets, fasteners, and materials to prevent galvanic action, or use appropriate insulation between dissimilar metals.



Figure 143. Tower, corroded metal vent cover at base of Lantern.

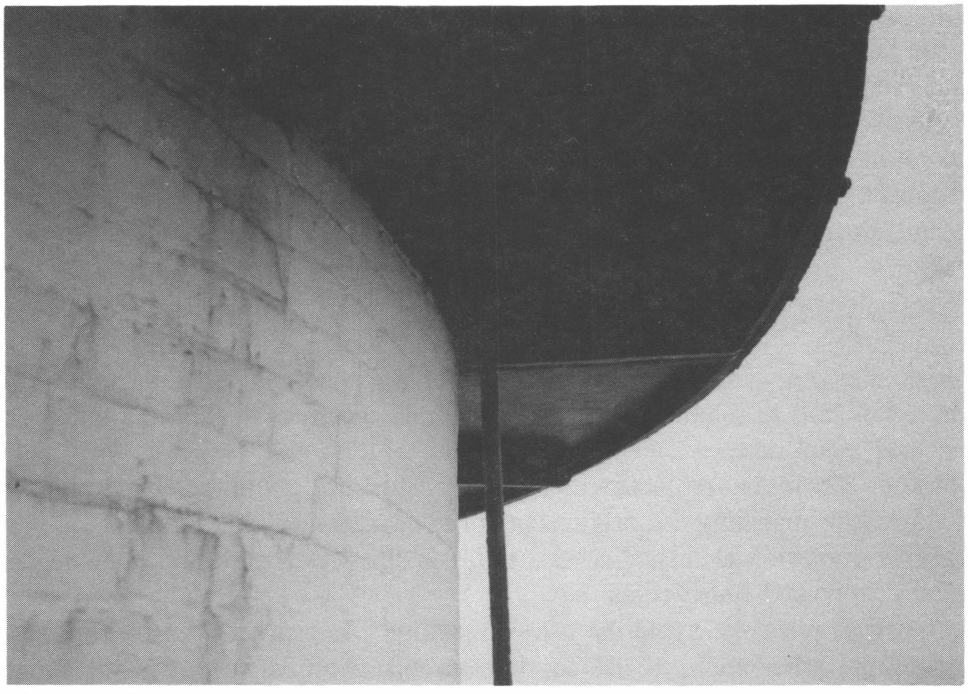


Figure 144. Tower, underside of metal floor of Lantern Gallery.

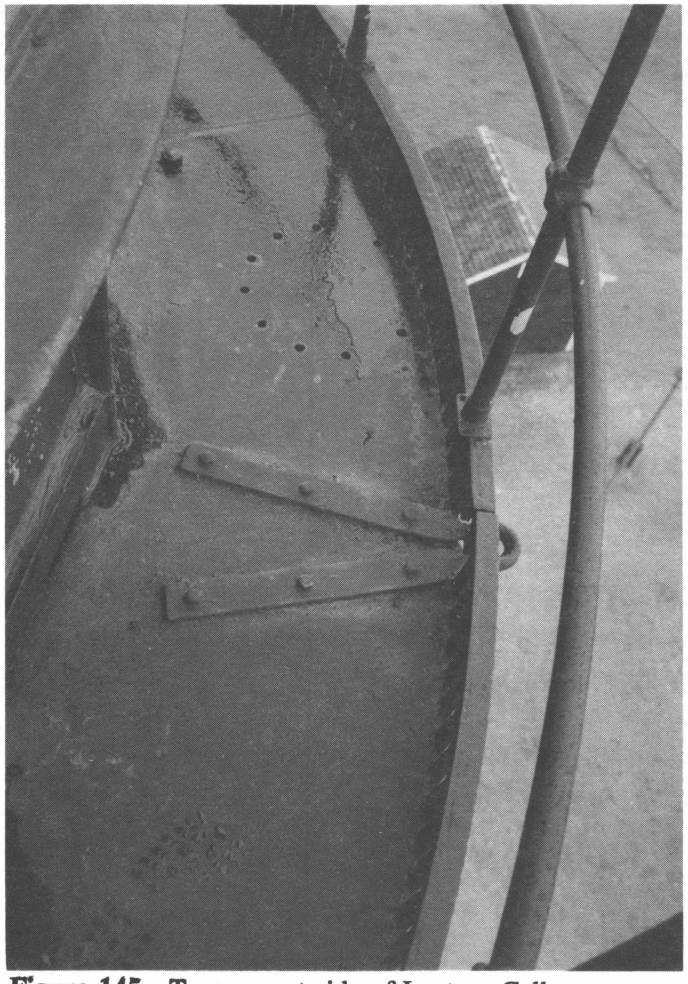


Figure 145. Tower, east side of Lantern Gallery.

Interior Elements

General Information

Conditions

The interior of the lighthouse demonstrates the penetrating effect of wind-driven, salt-laden moisture. There is a band of saturated brick (observed during a period of high relative humidity and intermittent showers) on the east wall, which begins at the Weight Deck and spreads uninterrupted down to the First Level. A tide line of salt deposits defines the outer boundary of this area. Salt crystals from either efflorescence, or salt coming out of solution from ocean spray, or both, are evident on the face of the bricks in two general forms: a heavy surface buildup of white crystals on the face of the bricks, and salt crystals tinted pink by brick powder as a result of the deterioration of the brick face. The base of the brick walls and the top of stair treads adjacent to the wall on the east elevation show accumulations of brick powder and salt crystals from deteriorating bricks above. The precise point of entry for the significant amount of moisture causing this problem is unclear. The condition is first visible associated with the exposed brickwork at the level of the Weight Deck.

The saturated walls and ingress of water has accelerated the deterioration of the metal stairway (and its landings) that ascends from the First Level to the Half Deck, as well as the floors of the Half Deck and Weight Deck themselves.

Recommendations

- Consider increasing ventilation for the interior of the Tower by unblocking selected existing vents at the Lantern Deck level, to assist in drying the interior during periods of high humidity. Vents should be controlled to prevent the ingress of windblown moisture.
- Periodically remove the sand from the interior to reduce abrasion of the painted metal stair and floor surfaces.
- Determine source of moisture penetration and correct.

First Level

Conditions

- The extensive moisture penetration that descends from the Weight Deck continues in a band several feet wide by the time it reaches the First Level, leaving deposits of salt crystals and brick dust on the floor.
- There are six holes along the perimeter of the wall, one course up from the floor. They are two courses high, approx. 4 to 8 inches wide, with a 5-inch air space beyond. Presumably they provide ventilation.
- Water stains are visible at the ceiling and wall between the Equipment Room and Tower.

- Currently, the two window openings at this level are filled with glass blocks that replaced earlier double-hung sashes. The only means of ventilation are two fixed louver vents, one in each opening, that measure approximately 8 by 16 inches.
- There is substantial water leaking at both window heads through the steel lintels, particularly the east window (figs. 146-149). The windows' sills, and the areas of wall and floor below the sills, are wet during periods of rain. A salt tide line is evident below the east window sill (fig. 149). Two lintels are delaminating from the extensive corrosion (figs. 146 and 148).

Recommendations

- Apply a damp-proof course at the new Tower foundation during relocation.
- Determine the source of moisture penetration above the windows.
- Replace the deteriorated metal-angle lintel at each window head.



Figure 146. Tower, head of east window in south wall, First Level.

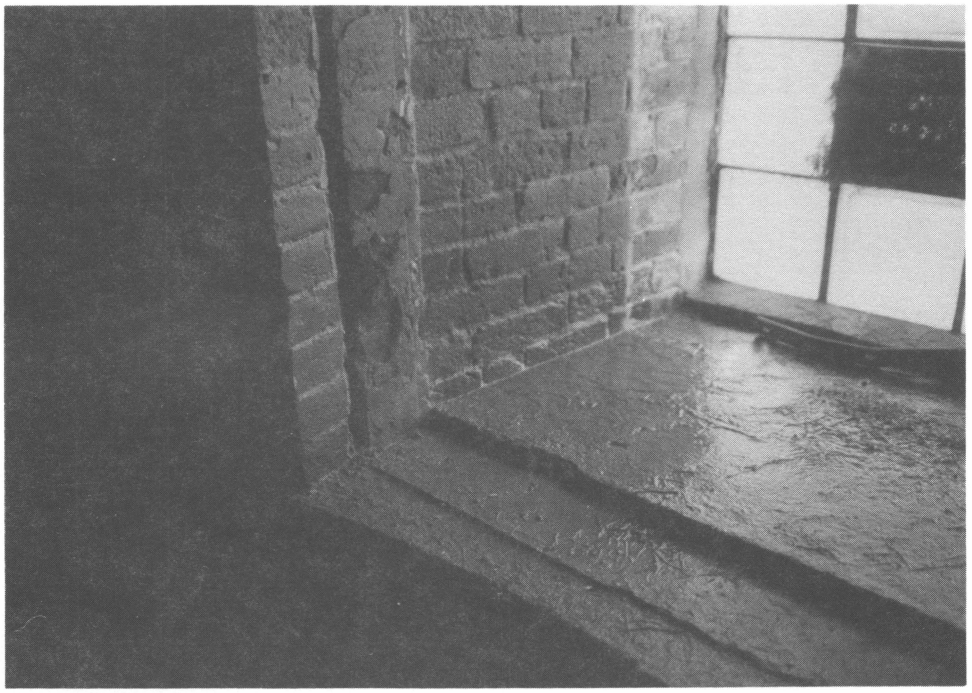


Figure 147. Tower, sill of east window in south wall, First Level.



Figure 148. Tower, detail of deteriorated metal lintels of south-wall windows, First Level.

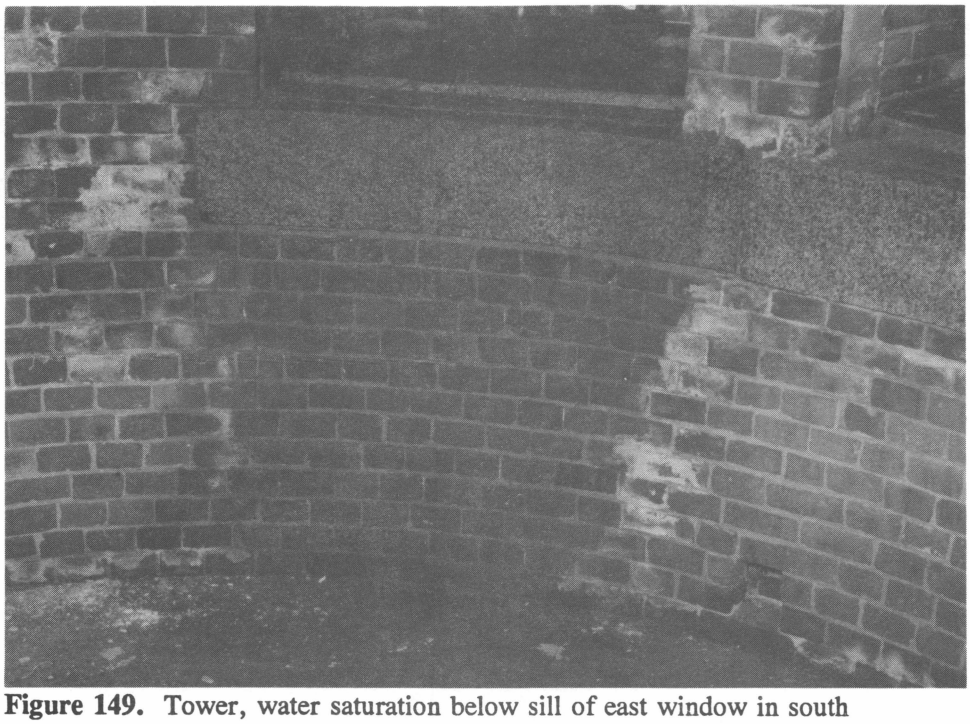


Figure 149. Tower, water saturation below sill of east window in south elevation, First Level.

Stairway

Conditions

- The metal stairway exhibits some corrosion, concentrated mostly on the bottom edges of the treads adjacent to the brick wall, where moisture collects (fig. 150).

Recommendations

- Scrape and paint all surfaces of the metal stairway.

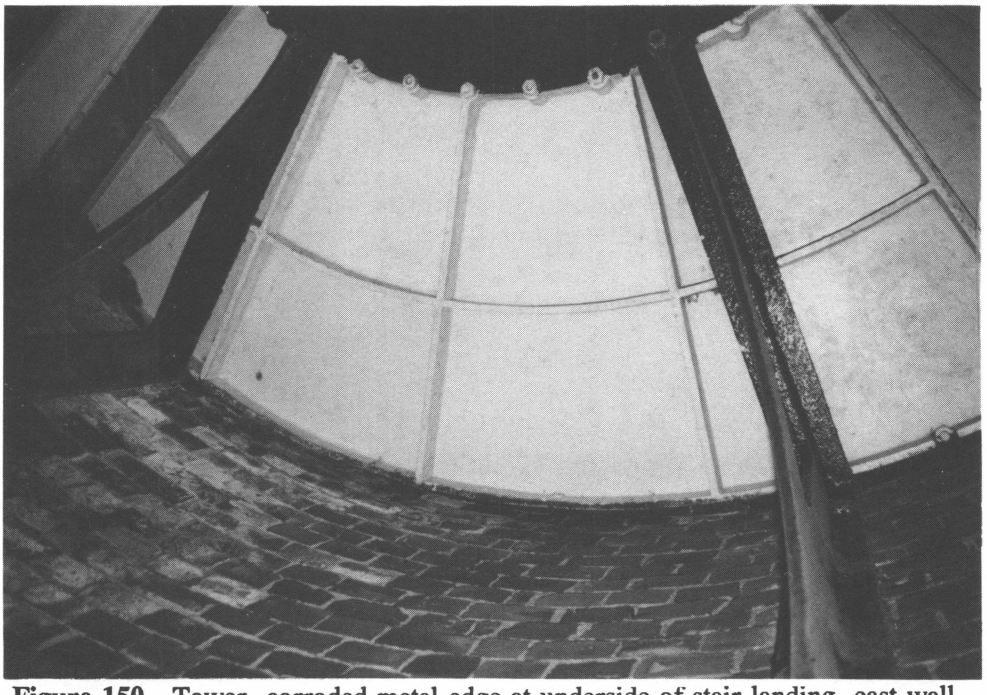


Figure 150. Tower, corroded metal edge at underside of stair landing, east wall of First Level.

Half Deck

Conditions

- The Half Deck (the top landing of the stairway) is composed of three metal floor sections. These are supported by three contemporary steel "I" beams running north-south and pocketed into the brick wall.
- Four holes due to missing bricks are located four courses down from the top of the wall. Through the holes can be seen a 9-inch air space between the brick withes.
- A vertical zone of saturated brick, with several salt tide lines visible on the east elevation, corresponds to the wet area at the Weight Deck above (fig. 151). There are also heavy deposits of salt crystals and brick dust that have collected along the outer edges of the stair treads and landings (fig. 152). The salt crystals are tinted pink from brick powder as result of the deterioration of the brick faces.



Figure 151. Tower, salt crystals on deteriorated brick faces, east wall of First Level.



Figure 152. Tower, deposits of salt crystals and brick dust at steps and stair landing, east wall of First Level.

Weight Deck

Conditions

- Water penetration at the interior face of the Tower wall first becomes apparent at the Weight Deck, where the east and south interior elevations were observed to be saturated and glistening wet during periods of rain.
- This water penetration is especially severe where the beam over the stairway to the Watch Deck is set into the southeast wall (fig. 153). The entire wall below the beam pocket was saturated and glistening wet during the period observed.
- This southeast beam pocket is a major source of moisture penetration. A diagonal stepped crack emanating from the bearing point of the beam is presumably easing the passage of moisture.
- The end of the beam is corroding where it enters the south wall. The steel treads of the stairway ascending to the Watch Deck are likewise corroded where they enter the brick wall.
- There is also corrosion along the edges of the metal floor plates here, as well as at the seams of the Watch Deck floor above. This is presumably due to the capillary action of moisture (fig. 154).
- There appears to be selective deterioration/spalling of brick units at various locations.
- Water is also leaking into the Tower underneath the granite sill of the doorway at Watch Deck level; this also runs down the interior face of the brick wall (fig. 155).
- There are two screened brick vents (one each in the east and west elevations) near the top of the wall, approx. 8 square inches in area, with the back of the granite deck visible beyond.
- An iron eye is located on the east elevation, four courses below the ceiling. Diagonal cracks in the brickwork emanate from the collar of the eye, due either to previous loading or to expansive oxidation forces (fig. 156).
- Orange staining of the metal Weight Deck floor adjacent to the wet area at the east wall indicates active corrosion that is insufficiently inhibited by the paint coating.
- By contrast, the west elevation is fairly dry.

Recommendations

- Scrape and paint all corroding metal.
- Repair the diagonal stepped crack in the masonry.
- Determine the source(s) of moisture penetration.
- Treat the ends of the stairway treads where they intersect the brick Tower wall, to provide a moisture barrier.



Figure 153. Tower, beam pocket in south wall of Weight Deck.



Figure 154. Tower, corrosion at edge of metal deck and flanges of Weight Deck.



Figure 155. Tower, granite sill of Watch Deck doorway, as seen from Weight Deck.



Figure 156. Tower, iron eye set in east wall of Weight Deck.

Watch Deck

Conditions

- Orange staining is visible emanating from behind the furred-out wooden interior wall where it is cut out for the top tread of the stairway to the Lantern Deck (fig. 157).
- The interior vertical tongue-and-groove wood siding, which measures 2 3/8 inches wide, has buckled at approximately every two or three boards. This indicates that it has sustained high moisture content for long periods.
- Corrosion deposits around the steel sill of the exterior doorway to the Watch Gallery may be a result of insufficient paint coating.
- There are several areas of active corrosion occurring along the joints between the four sections of metal flooring of the Lantern Deck above. As stated previously, the 1-inch-thick steel plates of the Lantern Deck's interior floor extends continuously to form the floor of the exterior Lantern Gallery. There is some separation of the south joint, presumably from expansive oxidation forces. The west joint appears to be free of corrosion, perhaps due in part to being protected from the ocean side. Water may be entering the joints by capillary action, may be wind-driven to the interior, or may be draining in from the negative slope of the deck.

Recommendations

- Install an astragal seal at the perimeter of the steel door to the exterior Watch Gallery.
- Install hardware to assure tight closure of the door.
- Determine the source of moisture penetration and the consequent corrosion of the top tread of the stairway to the Lantern Deck.
- As a temporary measure to reduce the ingress of water, apply sealant to all of the exterior joints and seams of the four floor plates. Permanent repair of the corrosion evident between the flanges at the connections of the four floor plates will be problematic. To adequately clean the metal surfaces for application of new paint, the sections would have to be dismantled, which would require the Lantern to be lifted off entirely.

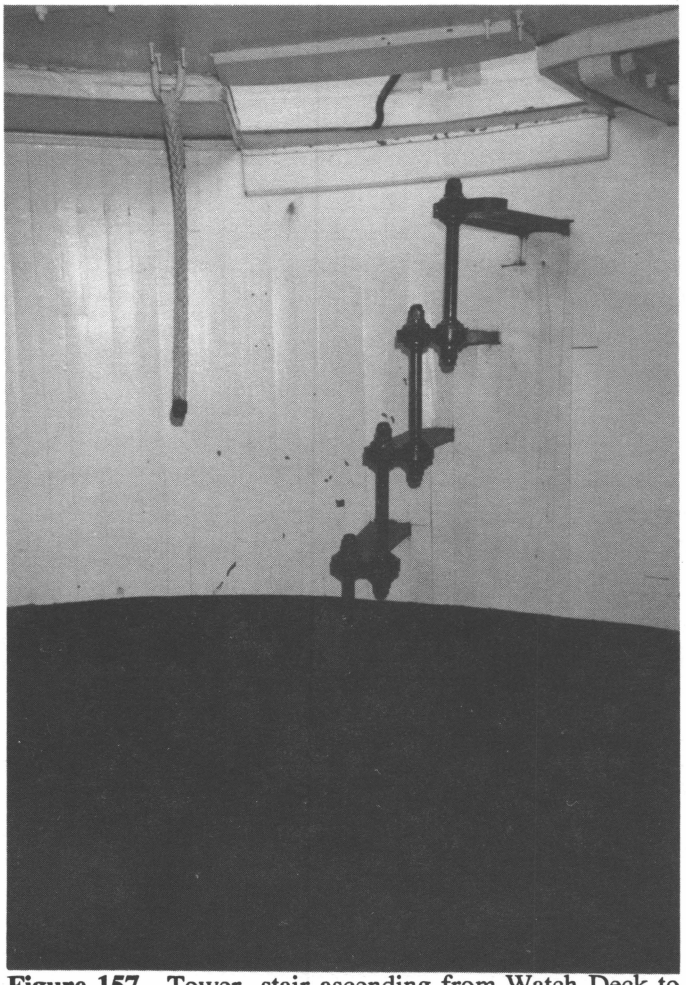


Figure 157. Tower, stair ascending from Watch Deck to Lantern Deck.

Lantern Deck

Conditions

- Orange staining is present on nearly half (7 out of 16) of the top surfaces of the steel channels that form the horizontal mullions between the Lantern's windows. This is a result of leaks at the windows, and is most evident at the east-facing windows (fig. 158).
- At the heads of the windows are small metal ventilation boxes that have three slots in their top surfaces. These appear to originally have been connected to similar, down-facing boxes on the exterior of the lantern. The exterior boxes would have admitted outside air, and the interior boxes would have emitted it into the Lantern Deck. The slots are currently filled in with concrete.
- One of the pins used to secure the vertical mullions to the horizontal window heads is displaced. It is located at the top of the west wall, next to the stair opening in the floor (fig. 159).
- A circular steel-plate floor in three sections has been added on top of the original floor, to support the existing replacement light.

Recommendations

- Consider increasing ventilation for the Lantern Deck by removing the concrete from some of the ventilation boxes at the heads of the windows. Vents should be controlled to prevent the ingress of windblown moisture.
- Consider providing weep holes in the steel channels that form the horizontal mullions between the Lantern's windows, to keep water from pooling in the channel.
- Reseal the window panels in their frames.
- Replace the loose pin at the top of the west wall.



Figure 158. Tower, corrosion staining at horizontal mullions of Lantern Deck window wall.



Figure 159. Tower, displaced pin at top of Lantern Deck window wall.

III. RECOMMENDATIONS FOR TREATMENT

GENERAL RECOMMENDATIONS FOR THE HIGHLAND LIGHT

Significance

According to the 1987 National Register nomination forms for the "Lighthouses of Massachusetts Thematic Group Nomination":

> Highland Light Station possesses integrity of location, design, setting, materials and workmanship as well as important associations with the development of aids to navigation in Massachusetts. Dating from the mid-nineteenth century, it is one of the better preserved complexes in the state, consisting of a tower, walkway, keeper's house and generator shed. It is also important as the site of the first lighthouse on Cape Cod. Additionally it exhibits many especially interesting individual features such as its elaborate wrought iron work [sic: interior metalwork mostly cast iron].

The thematic study as a whole designated the period of significance for Massachusetts lighthouses as 1679 to 1940, with architecture, engineering, maritime history, and transportation being the attributes for significant context.

The Highland Light complex needs to be relocated in order to survive, because of erosion. Nevertheless, it is also necessary to maintain the structures' contextual relationship to the themes of architecture, engineering, maritime history, and transportation. It has thus been decided to relocate the complex's structures into the adjacent Truro Highlands National Register District, and to rehabilitate them. While the lighthouse complex will be a separate site from the district, its relocation there will certainly impact the district. The choice of rehabilitation as the treatment for the complex will provide a balance between the variety of goals involved: the concern to minimize the impact on the district, the desire to maintain the lighthouse complex's own integrity, and the need to adaptively use some parts of the complex.

Relocation and rehabilitation will retain integrity of design, materials, workmanship, and association to the development of aids to navigation. Integrity of setting will be retained partially, because the relocation site will be only approximately 650 feet from its current site. Integrity of location will technically be lost. However, the National Register bulletin "Guidelines for Evaluating and Documenting Historic Aids to Navigation" indicates that necessary relocation of an aid does not automatically obliterate its integrity of location:

> Relocation of an aid during its active career if the move enhanced or *continued its function* is not a significant loss of integrity. . . . Aids to

> navigation relocated to serve new purposes after being decommissioned suffer a serious loss of integrity of location, but are not automatically precluded from listing.[1]

In the case of Highland Light, the function of the Tower and beacon as an aid to navigation will continue after relocation under U.S. Coast Guard jurisdiction, even though the Keeper's Dwelling will be assigned a new use and will be maintained by the National Park Service.

The Highland Light Tower, the Keeper's Dwelling, and the two connectors between them have been in continual use since their construction in 1856 and 1857. The extant dwelling was occupied solely by lighthouse attendants until 1987, when the beacon was automated. After that time, there was no longer a need for housing specifically for light keepers, nor was there any need for direct access from the dwelling to the tower. The dwelling therefore remained in use as housing, but for Coast Guard families; the doorway between the two connectors was blocked. This was the first change in the use of the connector in 130 years.

After the buildings are moved, the Tower will continue in its uninterrupted historic use as an aid to navigation for the foreseeable future. The Keeper's Dwelling will provide space for the interpretation of the lighthouse and surrounding site.

Character-Defining Features

The Tower with its "lantern house" is the most significant character-defining feature of the Highland Light Station. It is not only the most prominent feature at the site, but is also the most important one, because of its role as an aid to navigation. The Tower itself retains a great deal of integrity from its original period of construction, due primarily to its permanent construction materials. The characteristic of the light—its flashing signal—dates to around the turn of this century.

Other important exterior features include the relationship and form of all four interconnecting structures, their directional siting, and the vista provided by the approach along Highland Road to the site. This open vista is enhanced by the architectural integrity of the structures, including the fenestration of the west, most prominent elevation.

Significant interior features of the Tower are the decks and means of communication between the decks (stairway openings and stairways), and the beacon. The upper three decks and the two stairways between them are original. The lower stairway (from the First Level to the Weight Deck,

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[1] National Register Bulletin No. 34, "Guidelines for Evaluating and Documenting Historic Aids to Navigation," p. 8.

including the Half Deck) dates to the first decade of the 20th century; it replaced the original stairway, which wound around a center pole.

The Connector at the Keeper's Dwelling and the Tower Connector also retain a great deal of exterior integrity, based on their more permanent construction materials. However, the very recent (1987) blockage of the doorway between them has obstructed the historic internal circulation between the structures.

The only primary character-defining feature in the Keeper's Dwelling is its footprint, which is original. While a small amount of original trim remains (around one basement window on the main block's west elevation), the dwelling's present appearance dates mostly to a major remodeling performed around the turn of the 20th century. Features from that period include the form and basic floor plan of the dwelling, as well as some trim elements. However, even this work has been too badly fragmented by later alterations to be considered "character-defining."

Summary of Significant Periods of Alteration

A summary of significant dates in the life of the extant structures is as follows:

1856: Wood-frame Keeper's Dwelling constructed, sided with vertical board-and-batten siding, painted a brick-red color, and roofed with wood shingles.

1857: Brick Tower, wood-frame Assistant Keepers' Dwelling, and three brick connectors erected. Lantern fitted with a first-order Fresnel lens. Connecting structures painted brick red (to match Keeper's Dwelling); Tower whitewashed.

1881: Siding of both dwellings changed to clapboard and painted white. Connecting structures painted white to match dwellings.

1900: Keeper's Dwelling enlarged by addition of second story to original ell, new main entrance created from a window at north end of west elevation, old main entrance at south end of west elevation converted to a window, other fenestration changed slightly, three roof dormers added, and room configuration changed in both stories.

1901: Porch added to Keeper's Dwelling ell; new Fresnel lens installed in Tower, and characteristic changed from fixed to flashing light.

1903: Lower Tower stair replaced and Half Deck added.

1906: Lantern lining and cowl replaced.

1909: Second-story bathroom added to Keeper's Dwelling, along with fourth dormer.

ca. 1930: Porch at Keeper's Dwelling ell replaced.

1932: Station electrified.

ca. 1935: Dwellings' siding changed to wood shingles; connecting structures painted white to match Tower.

1946: Fresnel lens replaced with Crouse-Hinds 36-inch, double-drum, rotating DCB-36 aerobeacon.

1961: Assistant Keeper's Dwelling and the covered brick passage connecting it to tower were demolished.

1963: New Assistant Keepers' dwelling (an unattached duplex structure) erected on grounds.

ca. 1970: Main entrance of Keeper's Dwelling returned to its original location at south end of west elevation, former doorway filled in and shingled over (original window not recreated).

1987: Crouse-Hinds aerobeacon replaced with Crouse-Hinds DCB-224 rotating beacon during lighthouse automation; passage between Tower and Keeper's Dwelling blocked off; window opening on east elevation Tower Connector bricked in; window opening on west elevation of Tower Connector enlarged for plate-glass window; Tower window double-hung sashes replaced with glass blocks.

1987/92: Much exterior wood trim replaced.

ca. 1992: Majority of interior fabric at first-story level and some fabric at second-story level in Keeper's Dwelling replaced or covered with new material. All windows and most doors replaced.

Basic Treatment Recommendations

Exterior Recommendations

General Remarks

Most of the treatment recommendations are related to doorway and window openings. However, other important issues should be recognized at the outset of the relocation process. In all cases, historic photographs should supplement physical evidence in order to reproduce sympathetic replacement materials.

Foundations

The Keeper's Dwelling should be placed upon either a partial or full basement when it is relocated to its new site. A basement would increase air circulation and therefore help limit moisture problems. It would also provide the best location for utility-related equipment.

If a slab foundation of poured concrete is chosen instead, the exterior foundation walls above grade should be faced with brick. The bulkhead cover should be retained to give the appearance of a full basement, but it could cover a false opening.

Walls

The unpainted wood shingles on the exterior walls of the Keeper's Dwelling should be retained, and repaired or replaced as necessary. All wooden exterior trim elements should be repaired or replaced as specified in the previous section "Conditions Assessment and Repair Recommendations."

Porches

The steps to the wraparound porch at the Keeper's Dwelling ell should be moved from their current location at the west end of the porch's north side to their original location at the north end of the porch's west side. (The original steps did not have a railing.) Porch trim that has been replaced with incompatible material throughout the years should be replaced with elements more consistent with the majority of remaining elements. The painted plywood of the porch ceiling replaced a plaster ceiling circa 1950. Two options are available for this exterior installation: either the plywood should be replaced in kind and painted, or an exterior plaster (insulation finish system) should be installed to simulate the earlier plaster. The latter would probably be easier to maintain.

The storm porch that protects the main doorway on the primary, west elevation of the Keeper's Dwelling was added after 1981, based on photographs found in the National Register survey. This covering clearly affects the appearance of the facade and should be removed.

Doorways

The historic doorway pattern of the Keeper's Dwelling should be recreated. This will require reopening two doorways that have been closed with plywood, and hanging new doors there. One of these openings is in the east elevation of the Connector at the Keeper's Dwelling; the other is in the west elevation of the same structure. The design of the new doors should be based on historic photographs of the west elevation, which show a typical 19th-century door here (with two long recessed panels above two shorter recessed panels). Figure 27 provides a clear depiction of this style of door, albeit on the Assistant Keepers' Dwelling.

Also, the cement-block entry that serves as the current entrance to the tower should be removed, as should the interior door now in the doorway between the entry and the Tower Connector. A new exterior door of typical 19th-century style should be hung here instead.

Windows

The current fenestration pattern of the Keeper's Dwelling is mostly historic and should be retained. One original window opening (at the north end of the main block's west elevation), which was closed circa 1900, will need to be reopened. Evidence for the placement and size of this opening will be found in the wall cavity.

All window openings should be fitted with wood frames and double-hung, six-over-six wood sashes. A system of exterior storm sashes also should be designed based on the proposed HVAC system. If air-conditioning is not part of the utilities design, then the storm sashes need to be operative, with screen inserts for summer ventilation. The use of storm sashes (or other transparent window protection, preferably glass) is absolutely necessary because of the high winds and blowing sands inherent to the area.

The 1987 plate-glass window in the west elevation of the Tower Connector should be removed. The opening should then be reduced to its original smaller size through the installation of replacement bricks. The new opening should be fitted with a wood frame and double-hung, six-over-six sashes, similar to those that existed prior to the 1987 alteration.

The original window opening in the east elevation of the Tower Connector, which was bricked up in 1987, could also be reopened and fitted with a wood frame and sashes. This elevation does not face the main approach that will be taken by visitors to the lighthouse, but it does face the ocean and therefore those visitors returning from a proposed lookout near the bluff's edge. However, lighting-apparatus equipment currently hangs on the interior side of the connector's east wall. Thus, while it would be advisable to reopen this window for interpretive reasons, the final decision should be based on operational considerations for the beacon.

The glass blocks in the three window openings in the tower should be removed and replaced with wood frames and double-hung, six-over-six sashes. A system of ventilation should be devised whereby two or three lights per window admit air but not blowing sand.

Finishes

If a slab foundation is chosen for the Keeper's Dwelling, the brick-faced exterior foundation walls above grade should be painted a shade of white matching the number 10YR 9/1 in the Munsell color notation system (see app. B). The exterior walls of the brick connecting structures should be repainted white, matching Munsell 10YR 9/1. The exterior of the brick tower should be repainted white, matching Munsell 10YR 9/1. All wooden exterior trim should be painted white, matching Munsell 10YR 9/1.

Interior Recommendations

General Remarks

The treatment for the tower interior (other than maintenance or repair) should be minimal and decided jointly by the Coast Guard and National Park Service, based on its future exposure to the public. Since the tower will remain as an unmanned aid to navigation, it will require space for supporting equipment. It is recommended that the Tower Connector adjacent to the tower be retained in its current use as an equipment room.

Walls

The existing plasterboard on the walls and ceilings of the Keeper's Dwelling, first and second stories, should be retained. New plasterboard may be used to replace the old plywood paneling in the two south chambers, although care should be taken to save earlier fabric under the paneling.

The wall separating the two connectors (i.e., the wall between Rooms 108 and 110) should be removed, to recreate the original circulation pattern between the dwelling and tower. The single passageway thus formed could be used in the interpretive program.

Doorways and Windows

The circa-1992 doorway and window surrounds on the first story of the Keeper's Dwelling consist of dark-stained stock wood moldings. These should be removed and replaced with flat-board trim approximately 4 inches wide.

Finishes

All of the interior trim in the dwelling and connectors, and the interior window trim in the tower, should be painted a white color matching Munsell 10YR 9/1.

CODE CONSIDERATIONS AND RECOMMENDATIONS

Introduction

The structures of the Highland Light Station will continue in service after their relocation. The Tower will be used in its historic capacity as a major aid to navigation. Therefore, although the light station will be owned and managed by the National Park Service, the U.S. Coast Guard will control access to the Lantern level of the Tower. The Tower would therefore not be generally accessible to the public, but its history and use could be interpreted elsewhere on the site.

However, as stated previously, the Keeper's Dwelling has not been needed as housing for light keepers since automation in 1987. Several options for the reuse of the dwelling after its relocation have been identified. All of these would be impacted by local, state, and federal codes and ordinances. Referenced codes are the Uniform Building Code, 1988 ed.; the NFPA 101 Life Safety Code, 1988 ed.; and the Uniform Federal Accessibility Standards, 1988 ed.

Residential Use

Should the Keeper's Dwelling be used as a residence, lead abatement would be required under the following circumstance: if the dwelling were to be inhabited by a family with children under seven years of age, and if the dwelling was the only available residence to that family. Most of the painted finishes in the dwelling are recent and thus lead-free. However, two areas are known to contain lead paint—the stair hall and the second story. Not coincidentally, these are the areas that retain their historic fabric.

Interpretive Use

If the dwelling were to be used for interpretive purposes open to the public, two major categories of compliance must be considered. These are barrier-free access and life-safety provisions. (Barrier-free access may also be necessary for housing, again in the event that no other already-accessible housing is available.)

A plan for full compliance with barrier-free and life-safety requirements should be devised and submitted to the appropriate local, state, and federal agencies for consideration and approval. Certain allowances are granted to historic properties in the interest of saving valuable historic material without significantly compromising barrier-free considerations.

Barrier-Free Access

Entrance

The only entrance suitable for modification for handicapped access is the doorway in the ell's west wall, leading from the porch into the north vestibule. The main entrance on the west elevation of the dwelling could not take the visual impact of the necessary wheelchair ramp; the ell's south-wall doorway cannot be enlarged enough, due to insufficient width between walls, to make it accessible. Therefore, handicapped access into the Keeper's Dwelling should be routed up onto the porch, through the ell's west-wall doorway, into the north vestibule, and then into the room currently used as a kitchen.

This approach will require the construction of a wheelchair ramp along the north side of the porch, with a landing adjacent to and level with the porch floor. The location of the ramp at the north elevation minimizes its visual impact on visitors approaching from the west, as well as providing a partially covered approach to the entrance. Currently, the first story of the dwelling is approximately 2 feet above grade. Assuming a 26-inch differential between grade and the porch floor, a switchback ramp (1:12 slope) of two 13-foot runs terminates at a landing at the location of the existing porch steps. (However, the opportunity to reduce this differential, and thus the ramp length, should be considered during the relocation process.)

The material used for the new work should be compatible with the historic fabric. The wood decking used for the ramp surface could be integrated with the existing flooring. Painted metal pipe rails would satisfy the required point loading, as well as present a lighter appearance than wood railings. A wood frame with diagonal wood trellis installed at the base of the ramp (between finished grade and porch floor level) would match the base depicted in the historical photographs from the 1930's (e.g. fig 28).

The construction of such a ramp will require the relocation of the porch steps, from the west end of the north side of the porch, to the north end of the west side (their original location). As stated in the preceding section, this work is already planned. The ramp will also require some reworking of the porch skirt details. Figure 160 shows the proposed ramp and the relocated porch steps.

Once access has been provided to the porch, the ell's west-wall doorway will need to be modified. First, it should be widened to accommodate a 3-foot-wide door. Second, a platform should be built outside it, with a sloping section down to the porch floor (see figure 160). This is needed to help deal with the 3-inch difference between the current floor levels of the north vestibule and the kitchen. A maximum of three-quarters of an inch difference between adjacent floor levels

is allowed by code. Removing thresholds and beveling floor edges, at both the west-wall exterior doorway and the doorway from the vestibule to the kitchen, will reduce the 3-inch difference by half. The remaining 1 1/2-inch discrepancy must be addressed by building up the floor of the vestibule. The exterior platform is thus necessary to bridge the gap between the new, higher vestibule floor and that of the porch outside. The platform would have to extend 4 feet out from the doorway, for maneuvering clearance. The sloping section would have to extend out 30 inches from the platform, terminating 3-4 feet from the top of the ramp. (At a slope of 1:20, this section would not be considered a ramp).

The current door in the doorway between the vestibule and the kitchen has insufficient room to swing freely, according to code. Only the relocation of walls would solve this problem. Alternatively, the door could remain open during operational hours, if the west-elevation doorway on the main block were to be used as the primary entrance.

It is unlikely that the second story of the dwelling would be opened to public access. First, an elevator would be needed to provide handicapped access there. Second, as will be stated subsequently, the life-safety codes require two means of egress per story. Doorways and egress passages must meet specific minimum requirements for width, turning capacity, and door size and access. Given the limited area on the second story, it is infeasible to pursue public access there.

If the connecting structures are to be included in the interpretive program, the grade at one of the connectors' doorways should be level with its respective threshold, to accommodate wheelchair-bound visitors. Currently, the grade is level with three of the four doorways in the connectors: the west doorway of the Tower Connector, and both doorways of the Connector at the Keeper's Dwelling. (The built-up grade at the east doorway of the Tower Connector is 8 inches above the floor.) Therefore, public access from grade could be accomplished with minimum effort.

Toilet Facilities

Wheelchair access to toilet facilities within the dwelling would also be needed. The existing first-story half-bath is inadequate in size to accommodate an accessible toilet. A new toilet room would have to be built, with appropriate clearances and fixtures. Approved door hardware and rated doors at specified locations would be included.

Life-Safety Issues

The other major group of code requirements pertain to life-safety issues. Two means of egress would be required per story, as well as approved door hardware and rated doors at specified locations. Other life-safety equipment must include appropriate exit signage, smoke alarms, and fire extinguishers.

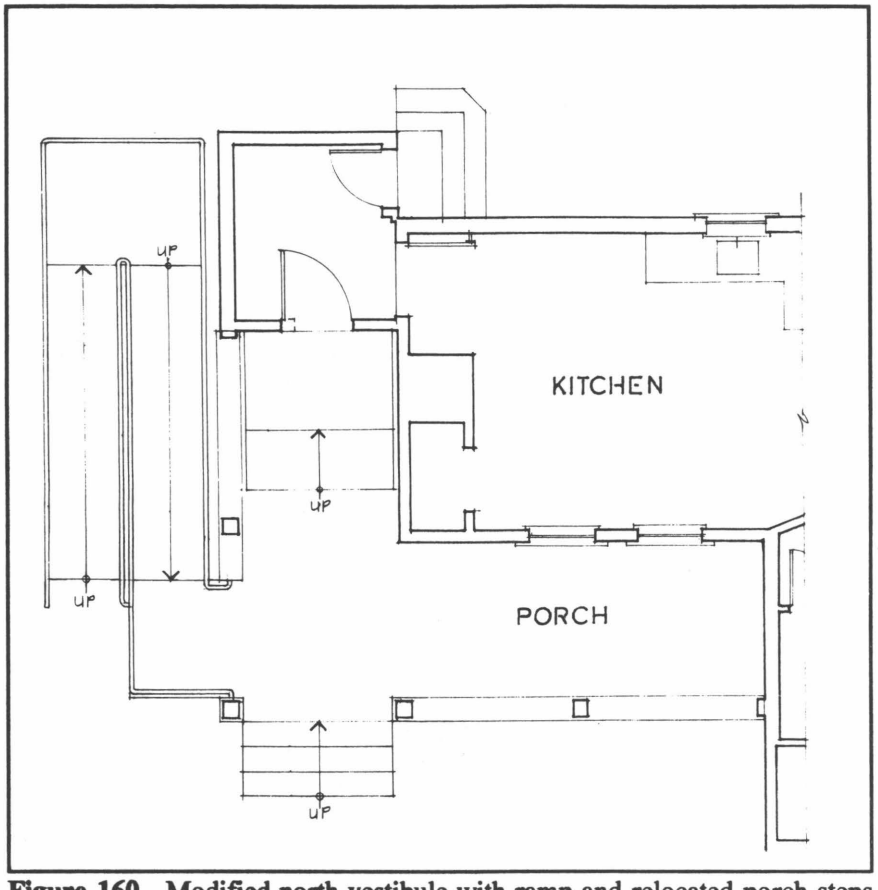
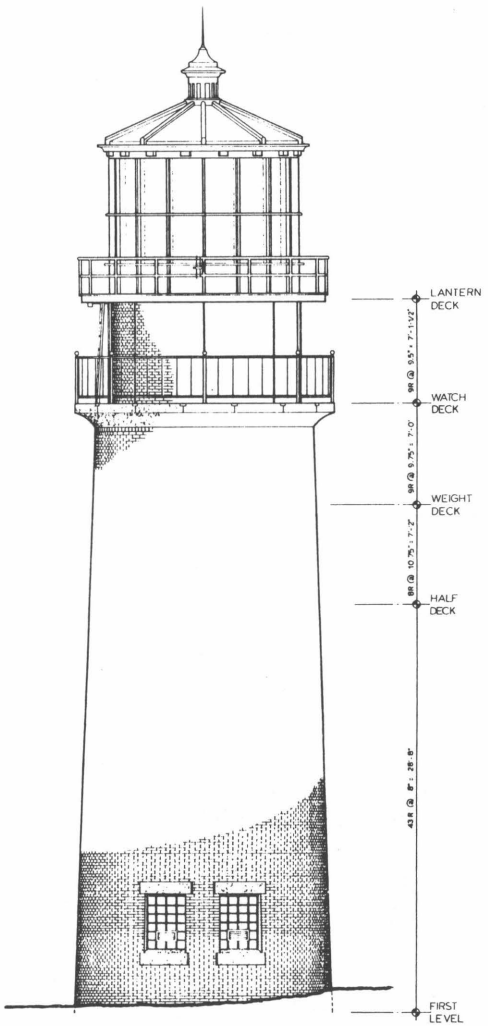


Figure 160. Modified north vestibule with ramp and relocated porch steps (refer to Appendix A).

IV. APPENDICES

APPENDIX A.

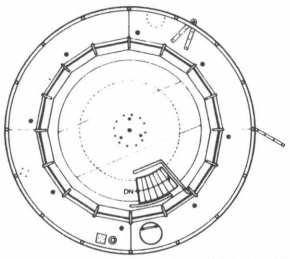
HIGHLAND LIGHT STATION
DRAWINGS, 1994



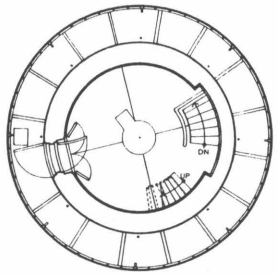
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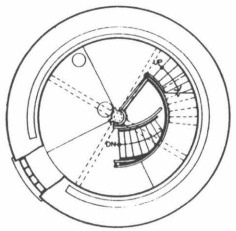
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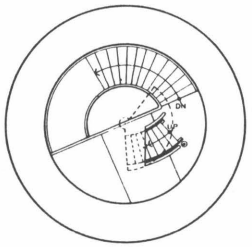
LANTERN DECK 4 & GALLERY



WATCH DECK 3 & GALLERY



WEIGHT DECK 2



HALF DECK 1

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EAST ELEVATION

1/4" = 1'-0"

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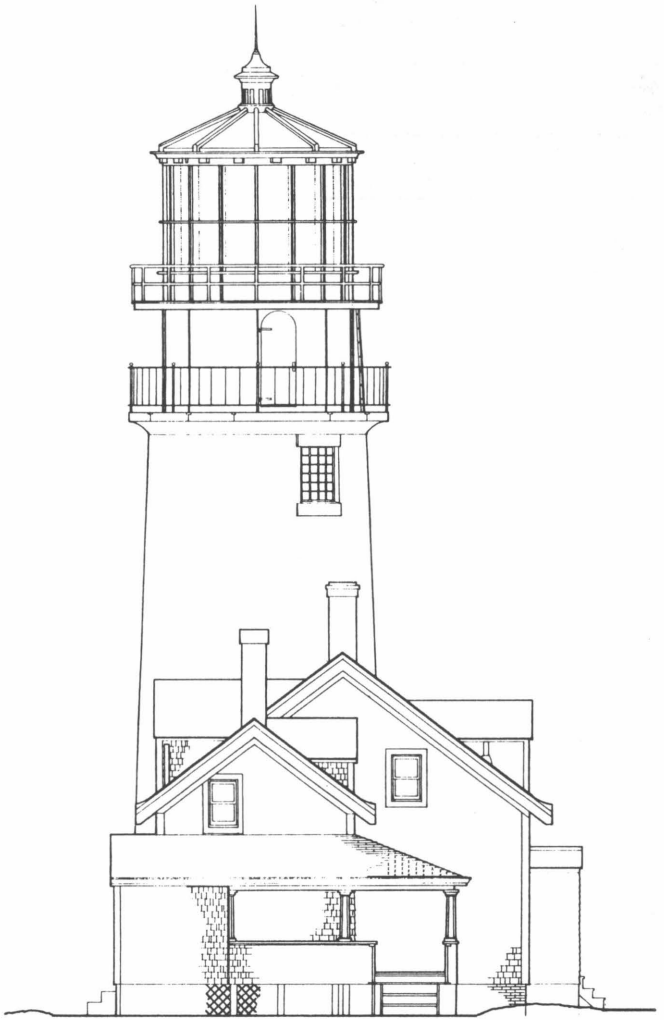


WEST ELEVATION

0 1 2 4

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NORTH ELEVATION

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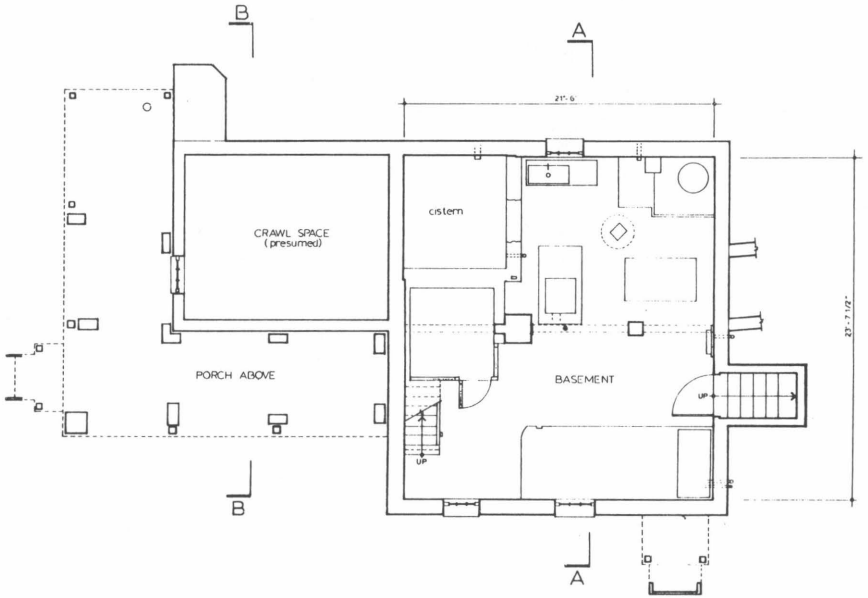


SECTION B-B

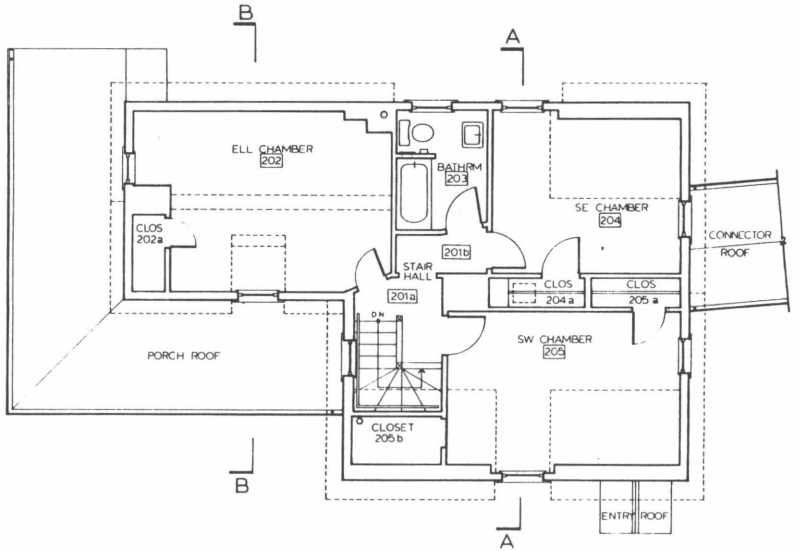


SOUTH ELEVATION

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BASEMENT PLAN

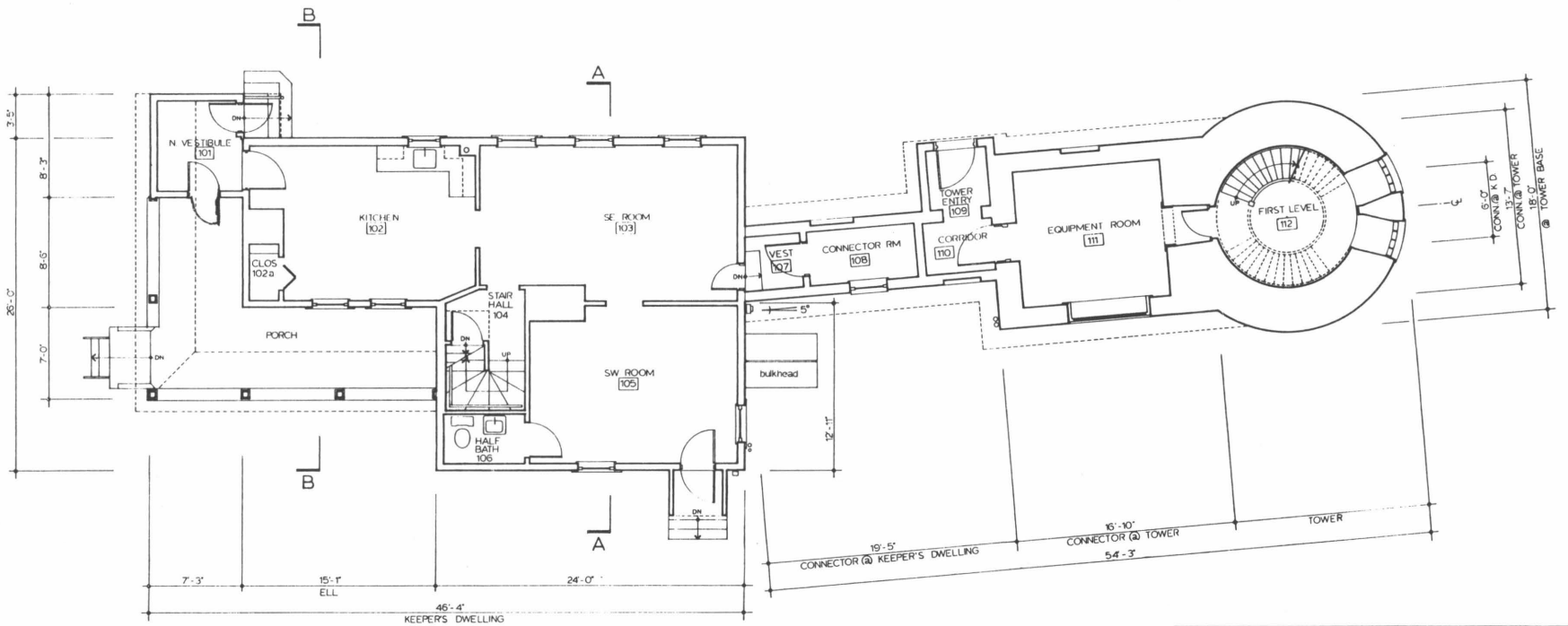


SECOND FLOOR PLAN

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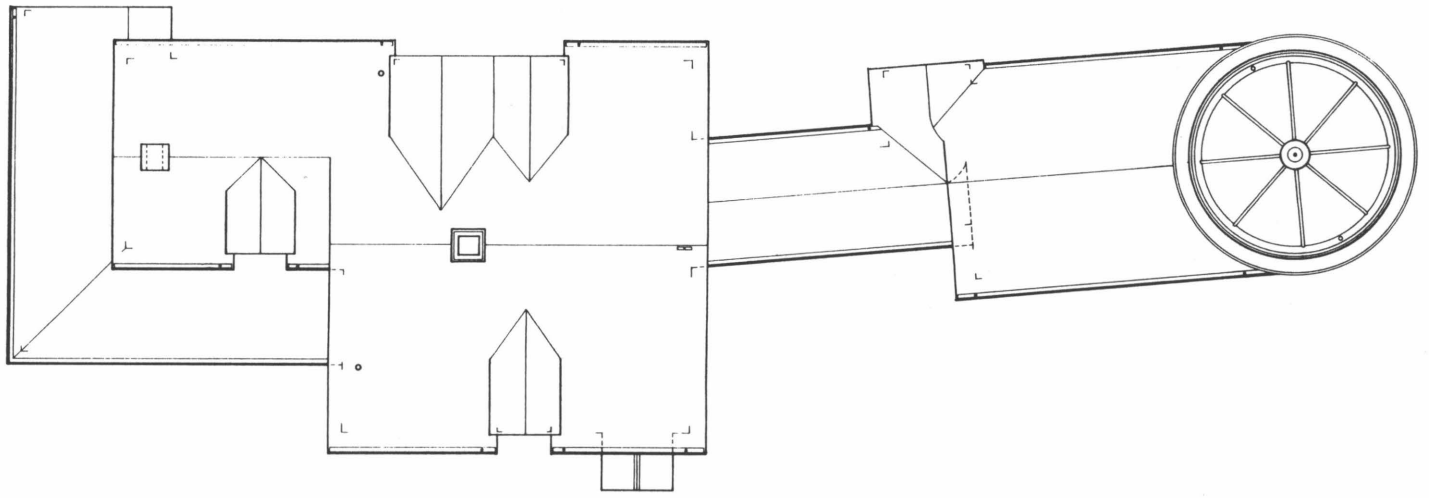


FIRST FLOOR / LEVEL PLAN

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ROOF PLAN

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1/4" = 1'-0"

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APPENDIX B.

PAINT ANALYSIS

PAINT ANALYSIS

Methodology

This paint analysis studied the four buildings involved in the Highland Light relocation project. These are the lighthouse, the Keeper's Dwelling, and the two small structures that connect the two main buildings. A total of 281 paint samples were removed from the exterior and interior of these structures. Each sample was removed using an X-acto knife and placed in a coin envelope labeled with its respective location. The samples were then brought to the Cultural Resources Center's laboratory, where they were assigned individual identification numbers. All numbers are prefaced by the notation "CACO HL" (for Cape Cod Highland Light), and all begin with the letter "P" (for paint sample). The numbers themselves run consecutively from P001 through P281.

Each sample was viewed through a Nikon stereozoom microscope using fiber-optic reflected lighting. Respective chromochronologies were recorded on individual sample cards and labeled with corresponding sample numbers. The majority of samples were also viewed under a trinocular Olympus BX50 microscope fitted with a narrow-band ultraviolet-light cube for fluorescing. The fluorescing chromochronologies were also recorded with the corresponding paint layers on the individual sample cards. The most representative samples were mounted in wax-filled petri dishes and labeled with their corresponding identification numbers. A minimal number of samples were microchemically tested under reflected light with hydrochloric acid (HCl) and sodium sulfide (Na_2S) to verify the presence of lime or lead, respectively, in paint stratigraphies.

The principle of comparative analysis was applied using the reflected- and ultraviolet-light chromochronologies. The UV chromochronologies were especially helpful for those samples that contained only white, off-white, and light cream-colored layers. These all appeared very similar under reflected light. However, ultraviolet-excited and -emitted light exposes a much wider spectrum of color, varying with the composition of the paint layer. Thus, the use of the UV chromochronologies permitted faster and more accurate comparisons.

The following discussion summarizes the results of the technical and comparative analyses of the paint samples. This process permitted the identification of dates when various pieces of building fabric were installed within the life of the structures, based on their painted histories. In cases where archival documentation and/or structural evidence provided specific dates for certain pieces of building fabric, these were found to agree with the dates obtained from the paint analysis.

It is important to note that the oils in paints tend to yellow in darkness, which occurs when they are covered by subsequent paint finishes. Therefore, although paint layers may appear to vary in color when viewed through the microscope, especially in the lighter range of whites, off-whites, and light creams, they may in fact have the same composition and have been the same color originally.

The following key provides abbreviations used in chromochronology charts in following pages:

Color Abbreviations Key

Abbreviation		
lt - light	ow - off-white	pk - pink
dk - dark	cr - cream	blk - black
brt - bright	yel - yellow	gry - gray
for - forest	or - orange	blu - blue
bk - brick	rd - red	grn - green
wh - white	gld - gold	brn - brown

Exterior Finishes

Little information about the age of extant exterior fabric of the light station structures can be obtained from the written documentation. Photographic documentation has provided the best evidence for identifying changes to the exterior. A comparison of both with the results of a physical examination indicates that the majority of brick and metal fabric is original to the 1856-57 construction. This includes the bricks used for the lighthouse Tower and the two connecting structures. Some of the bricks of the Keeper's Dwelling chimney also may be original. The metal lantern on top of the Tower appears to be the same one that was installed in the 1850's, but parts of it may have been modified.

Written documentation has established that the present form of the Keeper's Dwelling dates to that structure's 1900 renovation. Dormers were added to the main block, and the ell was raised to include a second story with dormers. If the porch at the northwest corner was not added at that time, it was added no more than a year or two later. Historic photographs show that the pedimented trim on the dwelling was changed when the building's clapboard siding was replaced with shingles circa 1930. The main doorway was moved twice during the life of the structure. The photographs taken between 1900 and circa 1970 show the doorway in its second location, to which it was moved in 1900. The latest archival photograph (fig. 36), taken circa 1970, shows the doorway moved back to its original position, at the south end of the west elevation. The hooded porch over this entry does not appear in any of the historical photographs, and was therefore added after figure 36 was taken.

Other photographs suggest that the board-and-batten bodies and wooden trim of both keepers' dwellings, and the brick connecting structures, were originally painted the same dark color. The Tower and brick foundation of the dwellings, on the other hand, were light-colored (probably whitewashed, as mentioned in some documentation). In 1881 when the dwellings were resided with clapboarding, all of the structures were painted the same color, probably white. The wooden trim of all of the station's buildings was painted in a contrasting color to the bodies of the structures at the end of the 19th century, as well as in the beginning of the 20th century. During this period, the bodies of the dwellings and connecting buildings were often painted in a different color than the Tower. The same evidence shows that the brick Tower was always painted white, or at least a very light color. The two small connecting brick buildings continued to have been painted the same color as the dwellings. After the dwellings were sided with shingles circa 1935, the connecting buildings appear to have been painted white to match the Tower.

Paint analysis has provided more specific information. While much of the early building fabric has been replaced, paint analysis helped date the extant fabric in a relative context. Where fabric could be dated through documentation, benchmarks dates were applied to other samples. One problem associated with exterior paint analysis at this site pertains to the environment: wind-blown sand has tended to abrade paint layers off of their substrates. As a result, some samples have fewer layers than they should have, and so could lead to incorrect conclusions. This problem was considered during the course of the analysis. One definite conclusion can be ascertained from paint analysis: the exterior was painted very frequently.

Two paint samples were difficult to read microscopically due to their deteriorated or eroded layers. The layers from sample P013 were so badly fractured that the sample could not be read. It had been removed from the raking eave trim on the east side of the concrete-block entry to the Tower. The second sample (P076) was taken from the beaded boarding of the west-wall doorway of the Keeper's Dwelling ell, leading from the porch to the north vestibule. The earliest layers were jumbled, but appeared to date no later than the seventh finish of the majority of paint samples found during the investigation.

Three samples (P104, P105, and P041) were removed from the framing elements of the basement windows. One sample (P063) was removed from the concrete stoop at the rear elevation of the dwelling's ell. All minimally related to each other and were initially hard to correlate to other samples.

Keeper's Dwelling - Foundation Level

DATES ↓	P104 W elev., N basement window	P105 W elev., S basement window	P041 E. elev., center basement window	P063 E. elev., concrete steps to N vestibule
substrate	wood	wood	wood	concrete
1856	rd/brn rd/brn			
	rd/brn rd/brn			
1881?	wh lt cr lt cr			
	wh oil			
	wh oil			
	wh			
	gry (/grn?-faded)			
	gry (/grn?-faded) gry (/grn?-faded)			
	gry (/grn?-faded) gry (/grn?-(faded)			
	charcoal gry			

last finish bef. 1900 renovation	gry gry gry			
*exact number finishes unknown	*			
1958?				dk grn
				dk blu/grn
				gry/grn
		for grn		dk grn/blu
		for grn for grn		dk blk/grn
bet. 1966 and 1978	brt grn	for grn for grn	grn/blu (weathered)	dk blk/grn
	sage grn sage grn	sage grn		grn grn
	sage grn	sage grn		grn grn
	sage grn sage grn	sage grn sage grn		grn grn
1992?	sage grn			

None of the darker greens found in the above four samples match other green paint layers found in exterior trim samples under ultraviolet light. This reveals that different kinds of pigments were used in those other layers. No sage green layers were found in any other exterior samples. While gray paint was used before and after the turn of the 20th century to provide a contrasting trim color, the green layers found in samples other than P104 date to a later time period than the grays.

Sample P104 represents the only known surviving exterior wood fabric original to 1856. It was removed from a basement window frame at the north end of the west elevation of the Keeper's Dwelling main block—a window opening that was covered over by a entrance stoop from 1900 to after circa 1970. During those decades it was protected from the elements and trim-replacement campaigns. It proves that the original painted finish of the board-and-batten house was a dark brick-red color; confirms that the trim (probably along with the main body) was painted white when the siding was changed to clapboards; and suggests that the contrasting trim colors used at the end of the 19th century were grays.

Sample P063 was removed from the concrete steps of the south-wall doorway to the vestibule of the Keeper's Dwelling ell. This sample contained eight different shades of green. A metal disk is implanted in the concrete, installed there by the U.S. Geodetic Survey organization in 1958. If the first coat of paint is contemporary to the installation of the concrete and implanted metal disk,

an average of four years can be computed between painting campaigns, which supports other calculations for general exterior painting campaigns at the site.

Samples P040 and P093 were removed from the brick foundation of the main block of the Keeper's Dwelling—from the east and west elevations, respectively. Sample P040 reflects at least six layers of whitewash immediately next to the brick substrate, followed by four finishes of paint. Sample P093 reflects those same later four (possibly five) finishes, but no whitewash layers, suggesting that they wore off in this location. Based on fragments of archival documentation, it was thought that the dwelling foundation was whitewashed for the majority of its history. While these samples do not prove this assumption, they lend support that the foundation was whitewashed at least during the earliest part of its history (corroborated by the earliest historic photographs), and possibly as late as the fifth or sixth from the last painting campaign. Records show that whitewash was being used on the site as late as 1952.

The number of observed finishes from other samples removed from masonry substrates varies widely. The sample with the largest number of finishes was removed from the Tower, from a section of spalled brick on the east side (P001). This sample reflected six or seven finishes, the first three of which are lime-based, probably a whitewash. The second finish was filled with sand. Whether this was an intentional coating or whether blowing sand impregnated the finish while it was being applied is unknown. Samples P005, from the north face of the Tower, and P020, from the north gable wall of the Tower Connector, only reflected three or four white-painted finishes. Three masonry samples showed only one or two finishes. These include P002, from the ground-level window sill of the Tower (paint over the concrete filler); P007, from the 1987 brick infill of the original east-wall window of the Tower Connector; and P022, from the brick east wall of the Connector at the Keeper's Dwelling. Usually a lack of paint layers is interpreted as representing newer material, as is clearly the case in samples P002 and P007. However, since photographs record that the structures were painted throughout their existence, one should recognize the severe impact of the blowing and blasting sand on exterior paint at this site. Sample P022 may represent this type of condition.

Photographic evidence shows that the circa-1900 porch was altered circa 1930. The ceiling of the porch was again altered after 1950, and all of the analyzed ceiling samples represent this period. The number of paint finishes in each porch ceiling sample confirms that this exterior element was painted every four years if the earliest date of ceiling fabric replacement was 1950.

Porch Ceiling Samples

DATES↓	P082 1/4 round	P083 ceil. batten	P084 ceil. board	P087 1/4 round
	wood	wood	wood	wood
ca. 1950	lt grn lt grn	lt grn	lt grn	lt grn

	brt grn brt grn	brt grn	brt grn	brt grn
	grn/blu grn/blu	grn/blue	grn/blue	grn/blue
	grn/olive grn/olive	grn/olive	grn/olive	grn/olive
			gry: not complete	
	wh wh	wh wh	wh wh	wh wh
	lt cr (smooth)	wh?		
	ow wh			
	wh	wh		wh
	wh		wh	wh2?
	wh	wh?		wh
	wh	wh	wh	wh

Paint sample P077, removed from the porch's easternmost pilaster, retains the one of longest exterior stratigraphies. Historic photographs suggest that this porch was rebuilt circa 1930, at which time the extant columns and pilasters were installed. If the pilaster does date to circa 1930, and if the number of finishes on it have been correctly assessed, then the porch's wooden trim was painted every three years, a conclusion based on 23 painted finishes during the course of 64 years. Alternatively, if the pilaster dated to the 1900 renovation and was reused circa 1930, then the trim at the station would have been painted every four years on average. Unfortunately little of this sample is comparable to the porch ceiling samples, since ceilings tend to be painted less frequently than other elements, often in different kinds of paints, and the earliest ceiling colors do not correlate to any colors found in the pilaster sample. However, comparison to other samples suggests that the first painted finish reflected in sample P077 dates to 1900.

A comparison of P077 and the exterior sample from the Tower door leading from the Watch Deck to the Watch Gallery (P004) indicates that they are very similar in layering. However, this does not mean that the door dates to 1900. The door is evident in a photograph from 1886, and also in two photographs probably taken in the 1890's; it appears to be whitewashed in the last two images. No such early white layers were found in sample P004: either they wore off or were removed, or the door was replaced. Since the style of the door is correct for the original construction period, it is more likely that the layers wore off.

Another exterior sample that merits individual discussion was taken from the rail of the Watch Gallery (P003). Its base coat is the color of patinated copper. It was not possible to take part of the metal substrate with the sample. It is thus difficult to ascertain if only one layer of this color exists. However, the green color is followed by four layers of black paint. Documentation shows

that earlier paint layers were sand-blasted off the metalwork in 1987. The green primer appears to be an anti-corrosive layer, followed by finish coats of black paint (probably two or three).

The physical evidence indicates that few original exterior wooden elements remain. Only one such piece—the previously mentioned basement window frame—can be identified as original through paint analysis. The absence of early wood components is most likely due to severe environmental conditions and the need to replace weatherbeaten wood frequently. As shown by groupings of similar paint samples, the replacements seemed to occur during several periods on an "as-needed" basis, rather than during all-encompassing campaigns.

Representative Exterior Samples

DATE ↓	P077 Keeper's Dwelling ell, porch pilaster	P078 Keeper's Dwelling ell, N vestibule, W entry in paint ghost	P004 Tower, exterior face of Watch Gallery door	P088 Keeper's Dwelling, W elev. of main block, dormer gable trim	P080 Keeper's Dwelling ell, porch, interior fascia at wall	P026 Connector at Keeper's Dwelling, W elevation, cornice gutter
	wood	wood	wood	wood	wood	wood
1900	lt cr/ow lt cr/ow	-	lt cr lt cr		blk	
	ow				gray lt gry	
	wh wh	lt cr lt cr	wh wh		gray lt gry	
	ow oily (dirty)	ow *dirt	ow		dk gry dk gry	
	ow/lt cr ow/lt cr ow/lt cr	ow/lt cr ow			wh dk gry	
	ow ow	ow ow			lt gry	
ca. 1930	ow ow	wh wh	ow (dirty)		gry	
	ow ow	ow ow	ow		ow (thick)	
	ow	ow ow	ow		ow ow	
	ow ow	ow (oily) ow (oily)	lt cr ow		gry	
	ow ow *fract.	ow ow	ow	wh wh	ow	
	ow (smooth)		wh	wh	lt cr	
ca. 1950	lt cr lt cr	ow		lt cr lt cr	ow/lt cr	lt cr/ow lt cr/ow

	lt cr *dirt	ow			lt cr	wh wh
	lt cr lt cr	ow		lt cr lt cr	lt cr	ow ow
	lt cr		lt cr lt cr	lt cr (smooth)	lt cr lt cr	lt cr/ow lt cr/ow
ca. 1961	lt cr lt cr	ow ow	cr	ow/lt cr ow/lt cr	ow/lt cr	ow ow
	wh	wh	wh	wh	lt cr lt cr	wh wh
	ow (smooth)	ow (oily)			lt cr lt cr	grn grn
	wh		lt cr	wh	lt cr lt cr	grn grn
	wh	lt cr	lt cr	wh	wh	grn
ca. 1987	wh (smooth)	wh	wh	wh	wh	grn grn
	wh wh	wh	wh wh	wh	wh wh	wh wh

Exterior paint samples and their locations are listed below, with those samples reflecting gray layers similarly to sample P080 noted with an asterisk [*], and those samples reflecting green layers similarly to sample P026 noted with a plus sign [+]. Only trim samples from the two connecting buildings display these green finish layers, which appear to have been used as trim colors for *designated* details from the 1940's to the 1987 paint scheme. Even though the gray finishes were earlier than the greens, samples do not reflect both the grays and greens within the same stratigraphy.

Those samples that reflected the lengthiest stratigraphies, date to circa 1900, and were contemporary to one another, include:

P004 Tower, exterior face of Watch Gallery door
[Note: The exterior side of this door was painted less frequently than the exterior trim found on the structures below, but UV fluorescence proved that it was contemporary to the earliest paint sample.]
P057* Keeper's Dwelling, E elev., band course under eave, N of dormer
P064* Keeper's Dwelling ell, N vestibule, S wall, beaded-board entry
P068* Keeper's Dwelling ell, N elev., E corner board
P077 Keeper's Dwelling ell, W elev., porch pilaster against vestibule
P080* Keeper's Dwelling ell, W elev., int. fascia of porch wall

The above samples date no earlier than circa 1900, based on the construction of the porch. Assuming that the sample from the circa-1930 pilaster represents reused material from the earlier (1900) porch, the above grouping of samples provides the benchmark date to the 1900 alteration.

The one sample that begins with a stratigraphy of the third finish is:

P078 Keeper's Dwelling ell, N vestibule, W entry, within paint ghost around door at entry

Samples with stratigraphies beginning at the seventh finish, which may date to circa 1930 (based on the porch rail sample), include:

P031+ Connector at Keeper's Dwelling, W elev., window frame
P033* Connector at Keeper's Dwelling, W elev., trim of blocked doorway
P051* Keeper's Dwelling, E elev., band course under eave S of dormer
P076 Keeper's Dwelling ell, W elev. doorway, beaded boarding
P081* Keeper's Dwelling ell, porch rail, N run near doorway
P092 Keeper's Dwelling ell, W elev., cornice fascia N of dormer
P094 Keeper's Dwelling, W elev., cornice gutter
P096 Keeper's Dwelling, W elev., cornice fascia
P099 Keeper's Dwelling, W elev., dormer, cut-through rake

Samples with stratigraphies beginning at the 13th finish and dating to circa 1950 (based on the porch ceiling samples) include:

P009 Connector at Tower, E elev., cornice gutter
P017+ Connector at Tower, entry, N face, cut cornice section
P021 Connector at Keeper's Dwelling, E elev., blocked doorway jamb molding
P026+ Connector at Keeper's Dwelling, W elev., cornice gutter
P027+ Connector at Keeper's Dwelling, W elev., cornice quarter-round molding
P029+ Connector at Keeper's Dwelling, W elev., window sill
P030 Connector at Keeper's Dwelling, W elev. plywood of blocked door
P032 Connector at Keeper's Dwelling, W elev., blocked doorway trim
P034* Connector at Keeper's Dwelling, E elev. trim of blocked doorway
P049 Keeper's Dwelling, E elev., S dormer rake trim
P056 Keeper's Dwelling, E elev., N dormer, cut-through rake
P058 Keeper's Dwelling, E elev., cornice gutter S of dormer
P082 Keeper's Dwelling ell, int. porch, quarter-round molding
P083 Keeper's Dwelling ell, int. porch, ceiling batten
P084 Keeper's Dwelling ell, int. porch, ceiling board
P087 Keeper's Dwelling ell, int. porch, quarter-round molding at wall
P088 Keeper's Dwelling, W elev., dormer gable trim

Samples with stratigraphies beginning at the 17th finish include (these samples appear to date to circa 1961 when the Assistant Keepers' Dwelling was demolished):

P008+ Tower Connector, N elev., rake fascia
P010+ Tower Connector, E elev. cornice fascia (board at N)
P011+ Tower Connector, E elev., cornice quarter-round molding
P012+ Tower Connector, E elev. cornice fascia (center board)
P014+ Tower Connector, E elev., entry, rake
P015+ Tower Connector, E elev., entry, pedimented trim
P016 Tower Connector, E elev., soffit
P018+ Tower Connector, N elev., cornice fascia
P023+ Connector at Keeper's Dwelling, E elev., cornice fascia
P024+ Connector at Keeper's Dwelling, E elev., cornice quarter-round molding
P025+ Connector at Keeper's Dwelling, E elev., cornice gutter
P028+ Connector at Keeper's Dwelling, W elev., cornice fascia
P042 Keeper's Dwelling, E elev., S end corner board
P047 Keeper's Dwelling, E elev., dormer cut-through, S rake board
P048 Keeper's Dwelling, E elev., S dormer corner board
P052 Keeper's Dwelling, E elev., soffit S of dormers
P055 Keeper's Dwelling, E elev., soffit N of dormers
P059 Keeper's Dwelling, E elev., cornice quarter-round molding (S of dormers)
P061 Keeper's Dwelling ell, N vestibule, E elev. rake, S side
P070 Keeper's Dwelling ell, N elev., recessed fascia
P071 Keeper's Dwelling ell, N elev., rake soffit
P072 Keeper's Dwelling ell, N elev., outer rake board
P073 Keeper's Dwelling ell, N elev., porch cornice fascia
P074 Keeper's Dwelling ell, N elev., porch cornice gutter
P075 Keeper's Dwelling ell, N elev., porch cornice quarter-round mold.
P079 Keeper's Dwelling ell, W elev., porch, plain doorway trim
P090 Keeper's Dwelling ell, W elev., dormer, W corner board of SW
P091 Keeper's Dwelling ell, W elev., dormer, N rake cut-through
P101 Keeper's Dwelling, W elev., main entry, plain door trim

Samples with stratigraphies beginning with the approximate 19th finish include:

P019 Tower Connector, N gable soffit
P038 Keeper's Dwelling, S elev., rake trim, E end (weathered)
P060 Keeper's Dwelling, E elev., cornice fascia S of dormers
P062 Keeper's Dwelling ell, S elev., vestibule entry rafter
[Note: This fabric appears to date to the porch construction, but remained unpainted until later years.]

Samples with stratigraphies beginning with the last one or two painted finishes include (and probably date to 1987 or later):

P006+ Tower Connector, W elev., plate glass window frame
P007 Tower Connector, E window infill, change in brick
P022 Connector at Keeper's Dwelling, E elev., brick wall
P035 Keeper's Dwelling, S elev., E window frame
P036 Keeper's Dwelling, S elev., rake at lower W end
P037 Keeper's Dwelling, S elev., 1st-story window frame
P039 Keeper's Dwelling, S elev., rake at E end
P043 Keeper's Dwelling, E elev., S window frame
P044 Keeper's Dwelling, E elev., middle window frame
P045 Keeper's Dwelling, E elev., N window frame
P046 Keeper's Dwelling, E elev., northernmost window frame (small)
P050 Keeper's Dwelling, E elev., S dormer window frame
P053 Keeper's Dwelling, E elev., N dormer corner board, E face
P054 Keeper's Dwelling, E elev., N dormer window frame
P065 Keeper's Dwelling ell, NE corner board of vestibule, N face
P066 Keeper's Dwelling ell, SE corner board of vestibule, S face
P067 Keeper's Dwelling, N elev., 2nd-story window trim
P069 Keeper's Dwelling ell, N elev., 2nd-story window trim
P085 Keeper's Dwelling ell, W elev., porch, S window frame
P086 Keeper's Dwelling ell, W elev., porch, N window frame
P089 Keeper's Dwelling ell, W elev., 2nd-story dormer window trim
P095 Keeper's Dwelling, W elev., cornice quarter-round
P097 Keeper's Dwelling, W elev., dormer window frame
P098 Keeper's Dwelling, W elev., dormer NW corner board, N face
P100 Keeper's Dwelling, W elev., 1st-story window frame
P102 Keeper's Dwelling, W elev., entrance porch, trim under eave, S face
P103 Keeper's Dwelling, W elev., entrance porch, interior plywood, S "panel"
P106 Keeper's Dwelling, SW corner board, W face

The samples listed just previously above represent fabric that was most recently painted. The majority of fabric has been replaced. This replacement may have occurred in 1987 when the beacon was replaced and other alterations occurred, or at the same time as the interior renovation of the Keeper's Dwelling, circa 1992.

Interior Finishes - Keeper's Dwelling

Basement

Documentation has revealed that a major renovation occurred in the Keeper's Dwelling in 1900, changing the locations of interior partitions as well as the staircases. This analysis included an attempt to determine if any exposed fabric remained from the original 1857 construction. Paint analysis of interior elements proved that very little of the extant fabric dates to the original construction. The only original painted material that is accessible is found in the basement. The majority of building fabric dates to the 1900 and circa-1992 renovations, while some elements may date to circa 1950.

Floor

Painted brick flooring is evident in the basement along the south wall near the east end. An early brick cistern, possibly dating to 1857, remains in the northeast corner of the basement. Physical investigation revealed that the majority of ceiling beams and joists and exposed subflooring of the floor above are original to the structure (1857). A patched space in the southeast corner of the ceiling reveals where the original staircase was located, running east-west between the joists.

The amount of paint on these elements is less than would be expected of original material. However, this is understandable, for two reasons. First, the majority of basement elements were was not originally painted. Second, the use of whitewash as a coating in the basement makes it difficult to compare samples, since the layers often delaminate between recoatings.

Six paint samples were removed from the floor of the basement. One (P133) came from the section of brick floor in the southeast corner that was left exposed when concrete was poured on the rest of the floor. One sample came from the concrete floor itself (P130). The others (P127, P131, P129, and P126) came from the concrete pads that were poured at several locations in the basement to provide level surfaces for various pieces of equipment. One sample (P124) was also removed from the "riser" that steps up from the floor to the bulkhead doorway in the brick basement wall.

Floor paint samples are typically incomplete, due to wear. Nevertheless, the Highland Light samples do provide some information. It is known from the history of masonry technology that concrete would not have been used on the dwelling's original basement floor. This floor would have been either brick or dirt; there is no evidence for either. Concrete may have been applied to the floor circa 1900; although this work was not specifically mentioned in the documentation, concrete floors were poured at that time in the passageways.

Comparison of the paint samples clearly shows that: (a) the brick floor was probably not painted before the concrete floor was poured on top of it; (b) the concrete floor was not painted until after the concrete floor pads were poured on top of it; and (c) the paint on the section of brick floor left uncovered by concrete in the southeast corner is no older than the paint on the rest of the floor.

The bulkhead riser appears to have been painted like the walls, rather than the floor, until the blue/gray finish was applied to the floor well after the bulkhead entrance was created circa 1900. Since no evidence exists to date the concrete floor pads, no dates can be applied to any of the painted floor finishes.

Two samples not represented in the following table include one removed from the bulkhead's brick retaining wall (P121) and one from one of the bulkhead's concrete steps (P122). Both of these samples contain only layers of red paint, nine from the former and eight from the latter. Two considerations affect these samples. First, although historic photographs show that the bulkhead may have been added during the 1900 renovation, its interior may not have been painted at that time. Second, the bulkhead's separation from the basement by a door may have discouraged its being painted the same color as the basement. In any case, the layers from both samples to not appear to be any older than the blue/gray and sage green finishes of the basement floor. No specific date can be applied to these finishes.

Basement Floor

P127 floor pad, SE corner, top pad	P131 floor pad, out from S wall, E floor half	P133 floor, painted brick at S wall @ E corner	P130 center of floor	P129 large floor pad @ SW corner	P124 riser to bulk-head opening, brick found. wall	P126 floor pad, SE corner, bottom pad
concrete	concrete	brick	concrete	concrete	brick	concrete
lt gry	lt gry	lt gry	wh			
dk gry	dk gry	gry	gry			
dk gry	dk gry		gry			
rd	rd fracture	rd	rd			
dk rd			rd (smooth)			
rd	rd	rd	rd (smooth)			
rd			rd (thin) *fracture			
rd	rd	rd	rd			
rd 2	rd	rd	rd			
rd			rd			
rd	rd	rd	rd			
rd			rd			
rd	rd	rd	rd		ow (oily)	
rd (oily)			rd		wh	

P127 floor pad, SE corner, top pad	P131 floor pad, out from S wall, E floor half	P133 floor, painted brick at S wall @ E corner	P130 center of floor	P129 large floor pad @ SW corner	P124 riser to bulk-head opening, brick found. wall	P126 floor pad, SE corner, bottom pad
rd (smooth)	rd	rd			ow	
rd					ow	
blu/gry	lt gry	wh			lt blu/gry	blu/gry
sage grn	ow/lt gry	lt gry			lt sage	sage grn
					dk grn/grn	
rd	rd (smooth, oily)	rd		bk rd	bk rd	bk rd
rd	rd	rd thick		bk rd	bk rd	bk rd
rd	rd	rd		bk rd	bk rd	bk rd
	rd	rd		bk rd fracture	bk rd	bk rd
	rd	rd		bk rd	bk rd	
	rd	rd		rd	bk rd	
	rd	rd		bk rd	bk rd	
	rd			bk rd	bk rd	
				wh	wh	
	rd			bk rd (thin)	bk rd	
				bk rd	bk rd	
				bk rd	bk rd	

Walls

The wall samples reveal that the basement walls were whitewashed, and that this was possibly an original (1856) finish. Visual examination of the brick cistern, located in the northeast corner of the basement, shows that additional widths of brick were added during the painted history of the fabric. The samples suggest that the cistern, possibly original based on archival information, was whitewashed for sanitary and waterproofing reasons (as was customary for the time). When the cistern was rebuilt or reinforced, a sand paint was applied only as the interior finish of the cistern wall. No specific dates can be applied to these paint layers.

Basement Wall Finishes

P111 W wall near N corner	P114 cistern, NE corner, exterior surface	P117 cistern, E wall above cistern	P118 cistern, interior S wall	P123 cistern, 1st finishes of orig. S int. wall
brick	brick	brick	mortar or parging?	brick
whwash	whwash	skim?		whwash
whwash	whwash	dirt		whwash
whwash	whwash			whwash
whwash	whwash			whwash
deteriorated	whwash			whwash
	whwash	whwash?	wh sand paint?	
	whwash			
	whwash	wh	wh sand paint?	
cr #? ↓	lt cr	ow		
	lt cr			
	lt cr	cr		
	lt cr			
	lt cr	wh		
	lt cr			
	lt cr	wh		
	lt cr	wh		
	wh	wh	wh	
	wh			

Stairway

All of the paint samples related to the basement stair are no earlier than 1900, when interior access to that level was relocated from the southeast corner. Samples P108, P109, and P132 appear to represent elements that are contemporary with each other. Samples P107 and P125 may also date to the same time period. However, because their substrates were probably originally whitewashed, and because whitewash is prone to fracturing off its substrate, this assumption cannot be proven at this time.

The middle paint layers of sample P109 are contemporary to the final paint layers of basement wall sample P114, based on exposure to ultraviolet light. This indicates that the main basement walls ceased to be painted during the middle painted history of the 1900 stairway. Since the stair elements may have remained unpainted after the 1900 alteration, it is difficult to ascertain if the initial finishes present today date to 1900. However, the most-heavily painted fabric has approximately 24 painted finishes. The similarity in number to the exterior painting campaigns could suggest that samples P109 and P132 are representative of 1900 fabric, and that P108 represents fabric that was first painted in 1900.

Basement Stair-Related Finishes

Date ↓	P107 N wall @ stair, above painted bb	P108 N wall @ stair, painted baseboard	P125 S wall @ stair, 1st-story level	P109 S stringer edge	P132 fascia band at cut-through, N wall
	brick	brick	masonry	wood	wood
1900		whwash		lt cr brt grn	ow charcoal gry
		whwash		lt cr for grn	
		whwash		gry/blu dk gry	gry gry
		whwash		gry dk gry	
		whwash		lt gry	ow/lt gry
		whwash		ow	ow/lt gry
		whwash	whwash?	ow	ow/lt gry
	wh	wh		wh wh	ow ow
	ow	wh	wh	wh	ow
	lt cr	wh	wh	ow/lt gry	lt gry

	lt cr	lt cr	wh	ow	ow
	lt cr	lt cr	wh	ow/lt cr lt cr	lt cr lt cr
	lt cr	wh	ow	lt lt blu	ow/lt blu
	lt cr	wh		ow dirt	
	wh	gry	wh	ow lt lt blu	ow/lt blu
	wh	wh (thin)	wh	lt lt grn lt lt grn	
	wh	gry	wh	lt gry	gry
		gry (thin)		dk gry	dk gry
				dk gry	
		gry		lt gry	lt gry
	wh dirty	wh	brt yel	gry/grn	
	wh	gry	brt yel	gry/grn gry/grn	lt gry
				gry	
	wh	gry	wh	med gry	gry

Miscellaneous Basement Fabric

Sample P110 (from the interior side of the bulkhead door) is contemporary with the two wood-substrate samples from the extant stair (P109 and P132). Therefore, the bulkhead was installed during the 1900 renovation. The exterior side of the bulkhead door and the exterior side of the jamb were painted less frequently than the interior side, with different paint colors.

The sample (P128) removed from the wood screen enclosure under the stair represents a recent addition to the basement, based on paint, hardware, and condition.

Miscellaneous Basement Finishes

Date ↓	P110 door to bulkhead, interior side	P119 & P120 door and jamb to bulkhead, exterior side	P128 wood screen enclosure under stair
	wood	wood	wood
1900	lt cr		
	ow (oily)		
	wh		
	ow (oily)	lt gry	
	wh/lt cr		
	wh (dull)	lt gry	
	wh		
	wh	ow	
	ow		
	ow/lt cr	lt cr	
	lt lt blu		
	lt gry		
	lt lt blu	lt lt blu	
	lt lt blu	lt lt blu	
	gry	gry gry	
	green/gry	dk gry/grn	
	dk gry/blu	gry	
	lt gry	gry	
	lt gry (warm)	sage grn	
	brn/gry		
	dk gry	dk charcoal	gry
	gry		gry

Ceiling Framing

Based on the following chromochronolgies, it was discovered that the ceiling framing was not painted until after 1900 (when the original basement staircase was removed and the corresponding area patched). The paint that these samples reflect was not applied until whitewash was no longer used as a coating in the basement. The paint layers representing the patched area and the original ceiling framing are contemporary to one another, but cannot be dated.

Basement Ceiling Finishes

P112 ceil. patch for former stair, SE corner, underside of subfloor	P113 ceil. patch for former stair, SE corner, subjoist	P115 NE corner, subflooring	P116 underside of ceiling joist
wood	wood	wood	wood
ow/lt cr	lt cr	lt cr	ow
ow/lt cr2?	lt cr		
lt cr	lt cr	lt cr	lt cr/ow
lt cr	lt cr lt cr	ow	ow
ow/lt cr	wh		wh

First and Second Stories

The current inhabitant of the Keeper's Dwelling related that the water pipes burst in the building in 1992, necessitating a fairly complete renovation, including all new kitchen cabinets and fixtures. A cursory visual examination of the interior confirmed this information; paint analysis supported that confirmation. The majority of wood trim and all of the windows have been replaced on the first and second stories. All of the first-story trim, except in the stair hall and bathroom, was replaced with stained, unpainted wood. Some trim was replaced on the second story, and it was painted. Most of the doors also were replaced. Except for interior closet walls, all first-story and some second-story walls were covered with plasterboard at this same time. Older 20th-century paneling is extant on some second-story walls. Paint analysis was able to identify all of the fabric from the latest renovation, as well as fabric that had been installed sometime between 1900 and the present.

Two apparent inconsistencies were discovered during the paint analysis of the interior samples of the Keeper's Dwelling. One was found in sample P141, taken from the north-wall baseboard of the first-story stair hall. It reflected only 12 finishes, with a yellow finish and pink finish falling consecutively in the middle of the stratigraphy. No other interior samples reflect these colors at the

same approximate time frame, nor does ultraviolet exposure correlate this sample to others from the Keeper's Dwelling. Therefore this fabric may have been installed as a replacement piece, reused from some other structure.

The second inconsistency was found in sample P183, removed from the door to the closet in the southwest chamber, and sample P184, removed from the casing of that doorway. The style of this door predates 1900 and was originally thought to date to the 1857 construction period. However, microscopic examination of its paint sample showed some evidence of residual paint in the wood substrate, suggesting that perhaps earlier paint layers were removed. If this assumption is true, then the door and doorway casing may have been stripped of original paint, and/or they may have been reused from another location.

It is known that the 1900 renovation required almost complete interior demolition. Furthermore, no paint samples displayed correlative data that might date them to 1857. It is therefore assumed that all of the sampled interior fabric above the basement level dates to the 1900 renovation or later. As many as 25 finishes (approximately) are evident in paint samples removed from the most frequently painted and oldest fabric. Analysis showed that the trim in the chambers on the second story was painted less frequently than the trim in the halls and stair hall.

Samples removed from the four closets of the three chambers show that the closets were painted much less often than the chambers to which they are connected. However, the 1899 floor plans and a visual examination of the closets suggests that they date to the 1900 renovation. Although the closets were painted infrequently, the baseboards appear to be contemporary to the other samples in this group, based on the earliest paint layers. The respective closet wall plaster samples directly correlate to the baseboard samples. Since no other painted wall-plaster samples were available, these were the only comparisons that could be made.

It is known from the documentation that two second-story closets servicing the ell and southeast chambers were altered in 1909 to provide space for a bathroom. The floor plan reflecting this change also notes that two old doors were reused. These doors have since been replaced, but paint analysis shows that their casings have not, suggesting that they were also reused in 1909. A paint sample removed from the baseboard of the north wall of the east hall (P167) also suggests that the baseboard section was reused at the same time, even though the hall was extended.

Samples representing confirmed 1900 fabric from the Keeper's Dwelling are listed below:

P143 1st-story stair hall, doorway to cellar, N side of casing
P145 1st-story stair hall, stair stringer baseboard, N side
P147 stair hall, fascia of 2nd-story landing overhang
L149 2nd-story stair hall, doorway to E hall, casing header
P151 2nd-story stair hall, doorway to SW chamber, jamb
P159 2nd-story ell chamber, N closet floor
P160 2nd-story ell chamber, N closet, N wall
P162 2nd-story E hallway, W wall baseboard
P164 2nd-story E hallway, doorway to bathroom, casing header
P165 2nd-story E hallway, doorway to SE chamber, casing header

P166 2nd-story E hallway, doorway to stair hall, casing
P167 2nd-story E hallway, N wall baseboard
P169 2nd-story bathroom, doorway casing, S side
P170 2nd-story SE chamber, N wall baseboard
P171 2nd-story SE chamber, doorway to E hall, casing header
P172 2nd-story SE chamber, doorway to W closet, casing header
P173 2nd-story SE chamber, closet, W wall
P174 2nd-story SE chamber, W closet, W wall baseboard
P176 2nd-story SW chamber, doorway to stair hall, casing
P177 2nd-story SW chamber, W wall baseboard
P178 2nd-story SW chamber, N wall doorway to crawl space, casing
P179 2nd-story SW chamber, E closet, floor
P181 2nd-story SW chamber, E closet, E wall
P182 2nd-story SW chamber, E closet, E wall baseboard
P185 2nd-story SW chamber, N crawl space, E wall
P186 2nd-story SW chamber, N crawl space, floor
P187 2nd-story SW chamber, N crawl space, E wall baseboard
P188 2nd-story SW chamber, N door to crawl space
P275 2nd-story SE chamber, E wall baseboard, S end section
P276 2nd-story SE chamber, E wall baseboard, middle section
P277 2nd-story SE chamber, E wall baseboard, N end of run
P278 2nd-story SW chamber, W wall baseboard, S end section
P279 2nd-story SW chamber, W wall baseboard, N of S seam
P281 2nd-story SW chamber, N crawl space, W wall plaster

One sample removed from the south-wall baseboard (P140) in the first-story stair hall may represent 1900 fabric, even though it reflects only five finishes. Exposure to ultraviolet fluorescence indicated that the first four off-white and white finishes may correlate to the first four finishes reflected in other 1900 samples. The fifth and final finish relates to the extant final finish found in all other samples. Since the baseboard appears to be worn and similar to other 1900 fabric, this evidence suggests that the middle 20 finishes wore off or were removed prior to the last repainting.

Two samples, both related to the south-wall baseboard of the ell chamber, appear to begin their stratigraphies one finish later than the 1900 samples. One sample is from the southeast corner jog (P153), and one is from the south wall (P154). Both of these samples represent replacement fabric that was apparently installed when the 1909 bathroom was added on the other side of the wall. The jog probably represents an alteration that was necessary for the new plumbing.

Representative Interior Finishes

Date ↓	P143 1st-story stair hall, basement doorway casing	P145 1st-story stair hall baseboard, inside wall, N	P153 2nd-story ell chamber, E-wall baseboard at jog	P180 2nd-story SW chamber, ceiling batten	P140 1st-story stair hall, S wall baseboard	P142 door to basement
	wood	wood	wood	wood	wood	wood
1900	ow (oily)	lt cr lt cr			ow	
1909	ow/lt cr lt cr	ow	lt cr		ow	
	ow/lt cr		ow ow		ow	
	cr (dk oil)	lt lt grn	ow/lt tan		ow	
	ow/lt cr	lt cr	ow/lt cr			
	ow/lt cr	lt cr	lt cr			
	ow/lt cr	lt cr	lt cr			
	lt cr (oily)		lt cr			
	wh	ow	lt cr			
	lt cr (oily)	ow	lt cr	cr		
	wh	ow/lt cr	ow	wh		
	wh	lt lt or lt lt or	ow			
	ow/lt cr	wh yellow	ow	wh		
	wh fracture	ow ow		wh		
	wh	lt cr/ow		cr		
	cr(thin)	wh		cr		
	ow/lt cr	wh	wh			
		lt cr				
	lt cr	wh		lt cr		
		wh				
		gry				

	cr	gld				
	ow	bk rd		wh		wh
	cr	grn				
	cr	gld/brn	cr/or			ow
	wh	bk rd	wh			wh
	ow	rd	wh	wh		
						lt cr/ow
		wh				
	cr	lt cr	lt cr	wh	lt cr	ow

A sample removed from the ceiling batten (P180) in the southwest chamber begins its painted sequence approximately 10 finishes later than the oldest interior samples. This would suggest that the ceiling probably was installed circa 1940. The style of the board-and-batten ceiling is sympathetic to this date. However, repairs for falling plaster were instituted in 1950, and the sample could also date to that time.

One sample was removed from the west wall of the southwest chamber (P280). It reflected no paint layers, only wallpaper, and displayed a wallboard substrate. This wallboard was probably installed around the middle of the 20th century, and was never painted, only covered with wallpaper.

Two paint samples reflect only five modern paint finishes, suggesting that some renovation or fabric replacement occurred before the pipes burst in 1992. They include P139, taken from the main entrance door on the west elevation of the main block, and P142, which represents the first-story door to the basement. These samples date to circa 1970 when the main entrance was relocated. Both samples were exposed to ultraviolet fluorescence, and showed only the last five modern finishes found in other samples.

Many samples represent the most recent renovation of 1992. One or two paint layers are evident in each of these samples. No samples were removed from the unpainted trim found throughout the first story. It is believed that this trim, although only stained, was installed at the same time as the newest trim interspersed in the stair hall and second story. This assumption is based additionally on similar molding profiles. The samples representing the latest renovation include:

P134 1st-story vestibule, N wall baseboard
P135 1st-story vestibule, S doorway to kitchen, casing
P136 1st-story vestibule, S-wall exterior doorway
P137 1st-story bathroom (former entrance), W wall baseboard
P138 1st-story bathroom, W wall chair rail
P144 1st-story stair hall, E doorway casing
P146 Stair to 2nd story, backboard for railing attachment, N wall
P148 Stair to 2nd story, N window casing

P150 2nd-story stair hall, doorway to ell chamber, casing
P152 2nd-story stair hall, doorway to SW chamber, casing
P155 2nd-story ell chamber, N window opening, trim piece below sill and above baseboard
P156 2nd-story ell chamber, N doorway to eaves storage, casing
P157 2nd-story ell chamber, W window opening, apron
P158 2nd-story ell chamber, W doorway, casing trim
P161 2nd-story ell chamber, W doorway, casing header
P163 2nd-story E hallway, E doorway to bathroom, casing
P168 2nd-story bathroom, S wall baseboard
P175 2nd-story SE chamber, W closet door

Interior Finishes - Connectors

The Keeper's Dwelling and the Tower are connected by a passageway consisting of two distinct sections. These are the Connector at the Keeper's Dwelling (immediately adjacent to the dwelling) and the Tower Connector (between the other connector and the tower). The Connector at the Keeper's Dwelling consists of four small rooms—Rooms 107, 108, and 110, and the Tower entry (Room 109). The Tower Connector has only one large room, the equipment room (Room 111). However, the hallway between Rooms 108 and 110 was blocked off in 1987. Rooms 109 and 110 therefore now relate primarily to the Tower Connector, and so will be considered as part of that connector.

None of the samples extracted from either connecting structure directly relate to interior samples found in the dwelling, except perhaps for the last few finishes. Unlike the whites that were applied in the dwelling, grays and greens were the early colors applied in the connector buildings. Not all the samples from the connecting structures reflect the same last finishes, either. Where the last whites and creams are found in the dwelling, some connector samples have reds, a light green, and tans. Unfortunately, the dwelling retains insufficient early first-story fabric in order to know if there was ever any paint correlation between the dwelling and the connectors. The evidence that was found suggests that no correlation existed.

The samples taken from Rooms 107 and 108 in the Connector at the Keeper's Dwelling, however, do correlate to one another. Representative stratigraphies are charted here. A comparison of these samples with samples extracted from Tower Connector rooms suggests that the oldest fabric in Rooms 107 and 108 was installed three painted finishes later than the oldest fabric in the Tower Connector. Therefore, a renovation must have occurred before the fourth painted finish in these stratigraphies, at a time prior to the blockage between Rooms 108 and 110. This renovation included the addition of the doorway between Rooms 107 and 108 (samples P193, P194, P195, and P202). The trim (P192) on the north side of the doorway has fewer layers than the other doorway samples, and so appears to be somewhat later. However, a burn scar is also present at the first paint layer. This first layer is similar in color to the first layers of the other samples associated with the doorway.

Therefore, the trim could still be contemporary with the rest of the trim, if a fire interfered with some intermediate layers.

The samples (e.g., P199) show that the window sashes in Room 108 was probably replaced at the same time that the baseboards (P191 and P196) in both rooms were replaced, along with the trim around Room 107's doorway into the dwelling (P189). The window trim (P197 and P198) may also have been replaced at this time, although these samples appear to contain an additional early finish. Based on comparisons to other interior paint samples, the relative installation date of the above-mentioned fabric is circa 1950.

Baseboard sample P196 is similar to samples P189 (from the beaded trim around Room 107's north doorway) and P191 (from Room 107's east-wall baseboard), except that P189 reflects white instead of brick red in its second last layer. Door sample P195 is similar to P194 from the trim around Room 108's north doorway. Samples P200 (from Room 107's ceiling molding) and P201 (from that room's ceiling) reflect only the most recent two or three finishes.

Connector at Keeper's Dwelling - Representative Finishes

DATE ↓	P199 Room 108, lower window sash	P190 Room 107, N doorway trim	P196 Room 108, W base-board	P197-98 Room 108, window trim & stool	P192 Room 107, S doorwy trim	P193 Room 107, S door	P195 Room 108, N door	P202 doorway threshold between Rooms 107/108
	wood	wood	wood	wood	wood	wood	wood	wood
1900						gry	gry gry	blu/gry blu/gry
							gry gry	blu/gry

						gry	gry gry	lt gry lt gry
						ow/lt gry	gry	lt gry lt gry
						ow/lt gry	ow ow	ow/lt gry
						ow/lt gry	ow ow	lt gry/blu lt gry/blu
						ow/lt gry	ow/lt gry	
					gry (burnt)	ow/lt gry	dk grn	dk grn
					peach/or	ow/lt gry	dk grn	gry dk grn
				wh gry gry	wh/peach peach	wh wh	peach peach	wh gry gry
					peach peach			
	wh gry	wh gry gry	wh gry	gry gry	gry gry	gry gry gry/grn	gry gry	rd rd
		yel		yel	yel (trace)	gry	gry gry	
		gry gry	gry	gry		gry	gry	rd
		wh wh	ow ow/lt cr	ow	wh		wh	rd
	lt cr lt cr	cr cr	ow ow	lt cr	lt cr			
	wh			ow		wh	wh	
	wh	wh	bk rd	pk/tan	lt grn		tan	rd rd
		wh	wh	wh			wh	

The interior paint samples from the Tower Connector also correlate to the interior samples from the Connector at the Keeper's Dwelling. This is not surprising, since the two structures were once internally connected. The longest stratigraphies of these samples reflect 24 finishes, a number not very different from the finishes found on circa-1900 exterior fabric, and not many fewer than the finishes found on circa-1900 interior fabric in the dwelling. Fabric in the small room just outside the equipment room (Room 110) is older than any fabric found in the Connector at the Keeper's Dwelling, based on sample P216, from the south doorway trim, under newer trim). The trim sample from the east doorway to Room 109 (P214) begins its stratigraphy two finishes later than its counterpart from the south doorway. The trim sample (P203) from the other face of the east doorway reflects a stratigraphy contemporary to sample P214. Therefore, the trim around the east doorway is not as old as that found around the south doorway. Three other samples from Room 110 reflect only the last painted finish of white. These include P211 (from the west wall; the substrate may be plywood), P212 (from the north-wall baseboard), and P217 (from the north wall; substrate may also be plywood). Unless this fabric was originally unpainted, which seems unlikely, these three elements were installed recently, probably during the 1987 renovation.

The samples from Room 110's west-wall baseboard (P213) and the newer piecing of the east doorway trim (P215) show that they were installed during the same circa-1950 alteration that affected the Connector at the Keeper's Dwelling.

It is assumed that the demolition of the Assistant Keeper's Dwelling and its enclosed walkway necessitated some alterations to what is now the entry to the tower (Room 109). This probably occurred circa 1961 when the assistants' dwelling was demolished. The samples from Room 109 suggest that the casing of the west, interior doorway and the concrete step of the east, exterior doorway were installed at the same time, well before 1961. Although the concrete may not have been painted originally, its sample (P208) reflects only one less painted finish at the beginning of its stratigraphy than the west doorway trim sample (P203). Documentation states that a concrete floor was laid in the covered way in 1899 or 1900; paint analysis indicates that this is an extremely plausible date for the casing and the step.

A sample was also removed from the painted baseboard section of the west doorway trim in Room 109 (P205). While it reflected five or six of the most recent finishes, traces of dark green were embedded in its substrate. A dark green paint layer was found at the midpoint of many of the samples from this room and the one adjacent to it. Dark green was also the color of the oldest, first two finishes found in sample P216. Exposure to ultraviolet light did not clarify any major difference in any of these dark green layers, suggesting only that the same pigments and mediums were used at different periods of time. Therefore, it could only be assumed that this sample represents the oldest fabric, and that intermediate layers have worn off. This assumption has some validity, in that another sample (P203) from the same element has layers from one of the earliest represented time periods.

Sample P209, from the concrete-block north wall of Room 109, is very similar to P206, from the brick west wall of that rom. However, it does not reflect any whitewash layers, and instead of displaying three finishes of red at the end of its stratigraphy, it reflects three finishes of white.

Very little paint was found in three other samples from the interior of the entry. Sample P204, taken from the west brick wall north of the doorway and above the baseboard, begins its stratigraphy with the last finish of bright yellow found in other adjacent samples. This is followed by three finishes of white. Samples P207 and P210 were removed from below the sawn-off doorway casing at the north side of the west doorway and from the ceiling, respectively. Each displayed the last three finishes of white-colored paint. Additionally, the ceiling sample reflected a thick white coating adjacent to the substrate and before the last three white finishes. This coating was fibrous, but was assumed to be something other than the substrate. Its composition was not tested and therefore is unknown. It is assumed that these three samples represent fabric that was installed prior to 1987, but not earlier than 1970.

Tower Connector - Representative Finishes

DATE ↓	P216 Room 110, S doorway trim	P214 Room 110, E doorway, old trim under new	P215 Room 110, E doorway trim	P213 Room 110, W wall base-board	P203 Room 109, W doorway trim, above pntd. base-board	P208 Room 109, concrete riser to E doorway	P205 Room 109, W doorwy trim, pntd. base-board	P206 Room 109, W wall N of doorway, pntd. base-board
	wood	wood	wood	wood	wood	concrete	wood	brick
	grn dk grn							
	dk grn dk grn							
	pk				pk			
1900?	wh lt gry dk gry	wh blu/gry blu/gry			dk gry	dk gry		
	ow/lt gry	gry			lt gry	lt gry		

	gry gry	wh wh			lt gry	gry		
	gry gry	gry gry				blu/gry blu/gry		whwash
	lt gry lt gry	gry gry			gry gry	dk gry		whwash
	lt blu	lt blu lt blu			lt blu/gry lt blu/gry	rd		whwash
	lt gry	gry			dk gry	brt yel		whwash
	dk grn	dk grn			dk grn	brt yel	dk grn (trace)	whwash
		dk grn				rd		whwash
	peach peach	peach			peach	brt yel		yel yel
	peach or	wh			wh peach	brt yel		yel yel
	gry gry	gry gry gry	wh gry	gry gry gry	wh gry	rd	gry	
	wh wh		yel	wh wh	yel	brt yel		brt yel
	wh	wh	gry	wh wh	wh		wh	bk rd
	ow/lt cr	ow/lt cr	wh wh	wh ow/lt cr	wh		wh	bk rd
	ow/lt cr	ow/lt cr	lt cr	ow/lt cr	lt cr	blk	cr	wh
	wh wh	ow ow			wh		wh	
	tan	tan	tan	bk rd		rd	bk rd	bk rd
	wh	wh wh	wh	ow		rd	bk rd	bk rd
	wh	wh	wh	wh		rd	bk rd	bk rd

Several correlations can be made to additional samples removed from the equipment room (Room 111). Sample P221, removed from the casing of the equipment room's north doorway, is contemporary to sample P216 from the other side of the doorway. Both of these samples represent the oldest consistently painted interior wooden fabric found in the dwelling or connecting structures. Samples P218 and P219, which are similar to each other, were removed from the same doorway in

the oldest consistently painted interior wooden fabric found in the dwelling or connecting structures. Samples P218 and P219, which are similar to each other, were removed from the same doorway in the equipment room, but represent fabric applied over earlier trim. Both of these samples appear to correlate to samples P193, P195, P202, P214, and P208. Since P208 is believed to represent circa-1900 fabric, samples that correlate to it would represent fabric that was installed at the same time. Therefore, the only sampled fabric in the three rooms of the Tower Connector that predates 1900 is the trim around both sides of the doorway at the north end of the equipment room. The paint on this trim (P216 and P221) predates the 1900 renovations by two painted finishes. It is not possible to assign dates to any of the pre-1900 painted finishes at this time.

The brick walls and ceiling of the hallway from the equipment room to the Tower are original to the 1857 construction period. Ceiling sample P230 may display finishes dating to the 1857 original construction, since the earliest layers appear to be whitewashes. However, due to the characteristic of whitewash and the fact that it easily fractures from its substrate, the number of original layers cannot be calculated with any certainty. The wall sample (P231) shows that it lost the majority of its middle painted layers. Its first layer of white may be a whitewash, as one would expect, but acid testing would react to the lime in its substrate and contaminate any reaction to the coating. Therefore, its composition could not be ascertained.

The metal doorway that separates the equipment room from the Tower is cast iron, and has the date 1840 cast into its surface. Documentation shows that a major renovation occurred to the 1833 lighthouse in 1840; this door undoubtedly dates to that renovation, being reused during the 1857 reconstruction. The reddish color found at the beginning of the stratigraphy of the sample from the door's frame (P229) may be rust encrustation, suggesting that the cast-iron elements related to the door remained unpainted until the beginning of the 20th century, and then was painted during the 1900 renovation. The two samples removed from the door (P227 and P228) seem to confirm this, except their stratigraphies begin much later in the sequence. Since the both samples are very similar, but removed from two separate locations on the door, one could assume that the door was removed from its hinges, stripped and cleaned of any rust, painted dark red, and rehung, all probably during the 1930's. Sample P227 is exactly the same as P228, represented here, except that its detail was highlighted in black during the last two painting campaigns.

Equipment Room - Representative Finishes

DATE ↓	P221 Room 111, N doorway casing, old molding	P218 Room 111, N doorway, W jamb	P220 Room 111, N doorway, attached trim piece	P230 Tower hall, brick ceiling	P231 Tower hall, brick wall	P229 Door to Tower, metal frame	P228 Door to Tower, painted grommet
	wood	wood	wood	brick	brick	metal	metal
				whwash			
				whwash			

				whwash	wh		
				lt gry/gry	gry gry		
				lt grn	lt grn lt grn		
	grn grn			lt gry lt gry	gry	rusty red?	
	grn			gry		rusty red?	
1900	 charcoal gry charcoal gry	wh charcoal gry charcoal gry		 charcoal gry charcoal gry		orange (red lead) dk gry dk gry	
	ow/lt gry ow/lt gry	ow/lt gry ow/lt gry		dk gry dk gry		gry lt gry/ow	
	ow/lt gry	ow/lt gry ow/lt gry		lt gry		lt grn	
	gry	ow/lt gry		wh wh		lt gry	
		lt gry lt gry		ow ow		dk rd	
	ow/lt gry ow/lt gry	lt gry lt gry		ow ow		wh rd	
	gry	gry gry		lt tan		dk rd	dk rd
	lt gry/blu	lt blu/gry	lt gry/blu	lt blu		gry	lt blu
						gry	
	lt or	peach	lt or			lt or	lt or
	 or	 or	 or	wh		wh or	 or
	gry gry	gry gry	gry gry			gry gry	blu/gry
	gry gry	gry gry	gry			dk gry	

	wh	wh	ow/lt cr	wh		gry gry	
	wh	lt cr	lt cr	wh		gry	
	ow	lt cr				wh	
	ow/lt cr	lt cr	lt cr	wh		gry	gry
	wh	wh wh	wh wh		wh	gry	gry blk
	wh wh	wh	wh	wh	wh	gry	gry blk

Interior Finishes - Tower

Unfortunately, the interior paint samples from the Tower do not directly correlate to those from the connecting structures, except in the last four or five finishes. The same correlation was found in the interior samples removed from the dwelling. At least 30 finishes were found in two of the tower's interior samples: P262, from the Watch Deck's brick wall between the circa-1901 vertical boarding and the doorway to the Watch Gallery; and P263, from the interior metal door jamb of the Watch Deck doorway. The two samples display the longest stratigraphies of any samples studied and reflect the same finishes, except that the jamb sample displays a layer of red lead next to the substrate. It is often difficult to differentiate between **all** finishes unless dirt layers are consistently prominent. These dirt layers were not prevalent in the tower's interior samples. Therefore, there may be more than the 30 finishes represented in the chart below in these two paint samples. Indeed, both samples may retain paint finishes dating to the 1857 construction period.

Since little documentation was found pertaining to alterations specific to the Watch Deck, it is difficult to assign dates to the fabric represented by paint samples. Clearly, samples P254, P255, P257, and P261 prove that the elements from which they came were installed later than those represented by P262 and P263. However, it is not known if they were installed circa 1900 or at some other time. Samples representing the vertical boarding might have been a helpful dating tool, except that the vertical boarding and the majority of wood trim at the Watch Deck level (P249, P250, P251, P258, and P264) was initially varnished, a finish that remained for an indeterminate number of years.

Other hopeful dating tools were the samples from the Lantern Deck floor (P267 and P268), which was documented as being covered by a steel plate when the Fresnel lens was removed and a new beacon was installed in 1946. Paint samples seem to refute the floor's installation, since approximately 24 painted finishes are evident in the sample (P267) representing the inner flooring section (which is more congruous with a circa-1900 installation). According to the documentation,

it seems that at least the inner floor section would have required a new covering in 1946, since it is this space that the lens would have occupied. Only 16 finishes are evident in the other sample from the outer section of deck (P268), which could date to 1946, based on an average of repainting every three years. The sample removed from the quarter-round molding strip that runs around the perimeter of the floor (P269) reflected a very similar stratigraphy to the sample from the outer flooring, and is contemporary to the same period. Initial physical investigation of the elements did not provide any clarification of this conundrum.

Two other samples may correlate to samples P257 and P267, although they reflect far fewer finishes. Sample P256 was removed from the railing around the stair opening in the Watch Deck floor. While all of its paint layers are red—except for the second to last one, which is a bright yellow—it only has a total of 13 paint layers, an average of 10 less than samples P257 and P267. Ultraviolet excitation of layers was somewhat inconclusive, but it is possible that several layers of paint fractured off, and the first paint application to this element is contemporary to samples P257 and P267.

What ultraviolet light exposure did prove, is that sample P256 correlates directly to sample P243, which was removed from the stringer of the stairway from the Half Deck to the Weight Deck. Their initial layers of red are the same, while sample P243 reflects three last finishes of black.

It is interesting to note that, in general, the samples reflecting the most paint layers were removed from the upper two decks. In addition, the replacement of the staircase below the Weight Deck in 1903 is documented, but paint samples removed from its components are not consistent to one another, making comparative analysis most difficult.

Interior of Tower - Representative Finishes

P262 Watch Deck, exposed wall @ doorway to Gallery	P261 Watch Deck, exterior door to Gallery (interior side)	P257 Watch Deck, threshold, doorway to Gallery	P267 Lantern Deck, floor of inner deck	P254 outer floor; P255 inner floor, Watch Deck	P268 Lantern Deck, outer deck	P250 Watch Deck, vert. board, above painted dado	P249 Watch Deck, vert. board, painted dado
brick	wood	wood	metal	metal	metal	wood	wood
wash?							
tan/gld							
cr/gld							
wh cr/gld							

ow ow	wh	ow dk rd dk rd	yel yel	rd		varnish (cor- loca-	varnish rect tion?)
wh wh	lt cr	rd/brn					
lt cr lt cr	lt cr	dk rd	dk rd dk rd	dk rd dk rd			
lt cr (frac.)	lt cr	rd/brn	wh rd/brn	rd/brn rd/brn			
lt cr	wh	rd/or	rd	rd			
lt cr lt cr	wh	rd/or	rd	rd			
lt cr lt cr	wh wh	rd/or	rd	rd			
lt cr lt cr	lt cr		rd	rd			
lt cr lt cr	ow ow	rd/or	rd	rd			
lt cr lt cr	ow ow	rd/or rd/or	rd rd	rd	rd rd		
lt cr lt cr	lt cr		rd				
lt cr lt cr	wh	rd	rd	dk rd	rd		
lt cr lt cr	wh wh	rd	rd	dk rd	rd		
lt cr	wh fract.	rd	rd rd	rd	rd rd		
lt cr lt cr	wh	rd	rd	rd			
lt cr lt cr		rd	rd	rd	rd		
lt cr lt cr	wh	rd	rd	rd	rd		
lt cr lt cr	wh wh	rd	rd	rd	rd		
wh wh		rd	rd	rd	rd		
wh	wh	rd			or or		

wh wh		rd	rd	rd	rd		
lt cr lt cr	wh	rd	rd		rd	wh	grn/gry
lt cr	wh	rd	rd	rd	rd		
lt cr	wh	rd	gry	rd	gry	wh	blk
wh wh	wh wh	rd	rd	rd	rd	wh wh	blk
wh wh	wh	rd	rd		rd rd		

The samples removed from the underside of the Lantern Deck (or the ceiling of the Watch Deck) fit into a more expected relative pattern based on documentary evidence. Here the sample from the center of the ceiling (P253) has fewer paint layers than the sample from the edge ring of the ceiling (P252). If the center section represents the same steel plate that was installed in 1946, then the ceiling was painted less frequently than the majority of other fabric. The same is true of the fabric represented by sample P252, which is believed to be either original or installed in 1901. However, the evidence is inconclusive, since it is unknown whether the fabric remained unpainted after its installation.

The paint samples from the Watch Deck's middle metal door in the doorway to the Watch Gallery suggest that it missed many painting campaigns. Sample P259 from the interior side is represented below; sample P260 from its exterior side is very similar to its counterpart, except it is missing the first layer of orange (red lead) and one layer of the last sequence of whites. Since this door was sandwiched between two other doors, it may have been forgotten when interior and exterior painting occurred.

A second sample (P266) removed from a lower aluminum panel of the Lantern displayed only two layers of white paint, unlike the five layers (four of white and one of yellow/green) reflected in sample P272 (shown here). This difference suggests that perhaps some paint delaminated from fabric is represented by P266. Regardless of the discrepancy, a circa-1970 photograph shows that the bottom row of Lantern glass was not replaced until after that date.

Documentation shows that the Lantern lining was replaced in 1906. It may have been replaced again, and it may not have been painted when it was originally installed. Whichever the case, the first paint finish in the stratigraphy represented by sample P273 does not appear to date to 1906.

Miscellaneous Tower Finishes

DATE ↓	P252 Watch Deck, outer metal ceiling ring	P253 Watch Deck, inner metal ceiling plate	P259 Watch Deck, middle door to Gallery, interior side	P273 Lantern Deck, ceiling	P271 Lantern Deck, lower mullion	P270 Lantern Deck, grid	P272 Lantern Deck, lower aluminum panel
	metal	metal	metal	metal	metal	metal	metal
	ow grn		or? wh?				
	grn grn						
	grn grn					whwash?	
	lt cr lt cr			or wh wh		whwash?	
1946 ?	lt cr lt cr	yel/gld	or wh wh	wh wh		whwash?	
	lt cr	yel		wh	rd/brn	rd	yel/grn
	wh wh	wh wh		wh wh	wh (thick)		wh wh
	wh	lt cr	wh	wh	wh		
	wh			wh	wh wh	wh	
	wh wh	wh wh		wh wh	wh wh	wh	wh
	wh	wh		wh	wh	wh	wh

Many paint samples from the interior of the tower indicate that fabric may have been left unpainted for years prior to its first pigmented coating. Without specific documentation of painting campaigns employing a certain color, or the date of an installation of a certain painted object, no dates can be assigned to the first painted finish of these details. For example, the circular iron staircase was installed between the ground level and Half Deck in 1903. Many of its elements reflect only three to six paint layers, beginning with a very bright blue-color reminiscent of the 1970's, rather than the early 1900's. These samples include:

P235 Underside of 9th tread from ground level
P236 Backside of 8th tread from ground level

P239 First landing, floor
P240 Second landing, floor
P241 Floor of Half Deck

Other samples beginning with the bright blue color include:

P234 Iron frame of iron door from ground floor to equipment room
P245 Stair between Weight Deck and Watch Deck
P247 Weight Deck ceiling beam

One sample (P237) was taken from the circular staircase stringer approximately 5 feet from the ground-story level. It reflected one layer of red paint between the substrate and the bright blue color. Another sample (P238), removed from a baluster at the circular staircase's first landing, reflects its fourth layer as the bright blue color. Its three previous layers include a red/brown adjacent to the substrate, followed by two red-colored layers. These two samples indicate that at some time, prior to the application of the blue paint and while the remainder of the staircase was left unpainted, the baluster and stringer were highlighted with red paint. Clearly, these samples—and others from which the blue paint is absent—show that the bright blue application was confined to the lower staircase and Weight Deck.

Samples P232 and P233 were removed from the Tower's concrete floor at ground level and from the metal plate in the center of the floor, respectively. Both samples reflect three layers of red paint. Since the concrete is not original and may have remained unpainted after its installation, no correlation can be drawn to date either the concrete or metal plate installation.

Five other samples reflect a minimal number of paint layers, which does not necessarily date their representative fabric to a more recent time frame. These include samples P242, P248, P246, P265, and P244. Sample P242 was removed from a baluster under the Half-Deck rail; sample P248 was removed from a tread on the run of stair between the Weight and Watch Decks. Both reflected only four paint layers, beginning with a red-colored layer, but followed by reciprocating red and black layers. In sample P246, removed from the Weight Deck rail supported by round balusters, only three paint layers were evident: a brick red-colored layer next to the substrate, followed by two black layers. The same is true for sample P265, removed from the pole riser support of the steps leading from the Watch Deck to the Lantern Deck: a gray/green colored paint is adjacent to the substrate, followed by two layers of black paint. This gray/green is the same color that was used to first cover the varnish finish found on the walls of the Watch Deck. Sample P244, removed from the stair railing between the Half Deck and Weight Deck, reflected only two layers of black paint.

APPENDIX C.

MORTAR ANALYSIS

METHODOLOGY

Six mortar samples were removed from various locations at Highland Light Station using a hammer and small masonry chisels. They were collected in plastic zip-loc specimen bags, labelled, and assigned identification numbers ranging from CACO HL M01 through CACO HL M06. Each sample location was noted on the respective sample bag in indelible ink. The samples were returned to the Building Conservation Branch's laboratory for analysis.

In the laboratory, each sample was visually examined for similar characteristics and then ground to a powder using a mortar and pestle, with care not to crush any aggregate. Individual samples were placed in beakers that had their weights recorded (and were labeled with corresponding sample numbers) and were weighed again. Small quantities of dilute hydrochloric acid (HCl) were added to individual crushed samples. (Hydrochloric acid [HCl] reacts with the lime in lime mortars, plasters, and cements.) Once this reaction ceased, the liquid in the beaker was poured into a labelled filter paper that had been weighed (and its weight recorded) and folded into a glass funnel. The funnel was fitted into a rubber stopper that was held upright by the stopper and fitted into an Erlenmeyer flask. The filtered liquid or filtrate was collected in the flask and its color noted. The remaining sand in each beaker was gently rinsed with fresh water and swirled to levigate the finer particles. Again the liquid was poured into the filter paper which collected the fines, leaving only sand or aggregate in the beaker. The beaker and drained filter paper were set under heat lamps to dry. Both the beaker containing the dried aggregate and the filter paper holding the dried fines were weighed. The fines were color matched to the Munsell Color Notation System. The aggregate and fines were then collected in separate test tubes that were labeled with the corresponding sample number. The tubes were capped with a lid and the samples were set aside for comparative analysis.

Samples M02 and M03 proved to contain a high fines content, indicative of the addition of clay. Their sand components appeared to retain uncrushed remnants clay after their first exposure to analysis. Based on the locations from which they were removed, the cistern, it was surmised that hydraulic clay was a component of their matrix: its presence required regrinding of "aggregate" and an additional exposure to dilute hydrochloric acid (HCl).

All of the calculations pertaining to sample, aggregate, and fines' weights were made from the initial records. The weight of the soluble material was determined by adding the weight of the aggregate and fines and subtracting the total from the sample weight. Percentages by weight of aggregate, fines, and soluble material were then calculated. These figures, notes from the initial visual examination, the filtrate colors, the fines' colors, and test tubes of resultant fines and sand were all used to make comparisons among samples. These comparisons helped to establish like groups based on similarities, and when incorporated with the documentary research, provided the basis for deductive conclusions.

ANALYSIS

Sample No.	Location	% by Weight (A.S. = acid solubles)	Fines and Sand
CACO HL M01	Keeper's Dwlg. Basement int., W. wall	Fines: 6.89% Sand: 67.80% A.S.: 25.30%	Fines: 10YR6/2 Type "A" Sand
CACO HL M02	Keeper's Dwlg. Basement int., cistern, S. interior wall (post-original)	Fines: 27.69% Sand: 44.19% A.S.: 28.12%	Fines: 10YR7/2 Type "A" Sand
CACO HL M03	Keeper's Dwlg. Basement int., cistern, original sect. of S. wall	Fines: 24.97% Sand: 40.17% A.S.: 34.86%	Fines: 10YR7/2 Type "A" Sand
CACO HL M04	Tower exterior ground level, S.W. glass block window opening, cement parging on sill	Fines: 6.90% Sand: 74.36% A.S.: 18.73%	Fines: 10YR7/1 Type "B" Sand
CACO HL M05	Tower interior first floor level	Fines: 17.29% Sand: 37.61% A.S.: 45.10%	Fines: 10YR6/2 Type "A" Sand
CACO HL M06	Tower interior weight deck level, window opening, bottom parging layer of two	Fines: 16.76% Sand: 31.90% A.S.: 51.34%	Fines: 10YR8/1 Type "A" Sand

Samples M01, M02, M03, and M05 share the same sand source, labelled as Type "A" for this study. This sand is a beach sand, off-white to light tan in color, interspersed with black and orange particles. It is composed of small to medium-sized granules, some of which are quartz.

Unfortunately, sample M01 was removed from a damp basement wall (a condition that often causes lime to leach from a mortar) and sample M05 was too small to provide an accurate representation of its components. However, several assumptions can be drawn due to similarities in these four samples and the locations from which they were removed. All four *appear* to represent original mortars dating to 1856 and 1857. The mortars used in the foundation of the Keeper's Dwelling and the Tower may have been similar lime mortars, due to their softness and similar fines' colors. Hydraulic clay was added to the mortar used to construct the cistern in the basement of the dwelling, but use of the same sand as in the other two mortars suggests that the cistern was constructed at the same time as the dwelling's foundation. The similarities between samples M02 and M03 also suggest that they were constructed at the same time, but physical evidence shows that the interior cistern wall was added later. All of this combined information does not lead one to draw any specific conclusions, but generally it seems that all four samples represent **early** mortar installations, three of which may be original (1856-57).

Sample P04 reflects components of a portland cement parging, due to its hardness, fines' color, and low percentages of fines and acid-solubles. History of cement technology provides that the widespread use of domestic portland cement occured after 1900. Historic photographs show that this window sill addition of cement parging did not take place until after a 1959 photograph had been snapped. Therefore, sample M04 represents a portland cement installed after 1959. By this time, a different sand source was used. The sand found in this sample, labelled Type "B" for this study, is similar to Type "A" sand, except it also contains large and extra large-sized particles in white, off-white, gray, and black colors.

Sample P06 represents either a natural (hydraulic) cement or a portland cement parging, due to its hardness. Its sand component is the same type as was found in the earliest samples, meaning only that the same sand source was used. Due to the location under later parging, from which it was removed, and its higher percentages of fines and acid-solubles, one might assume that it was a natural cement rather than a portland cement. Use of domestic natural cement was prevalent from circa 1820 to circa 1900, but most often was used for conditions requiring hydraulic properties, such as bridge abutments or river and ocean fortifications. However, this use was not exclusive. Due to the differences in its sand, fines, and weight percentages, it is definitely not similar to sample M04 and therefore represents a different installation period. Its differences from the other samples also exclude it from a category of original installation.

APPENDIX D.

MOLDING PROFILES

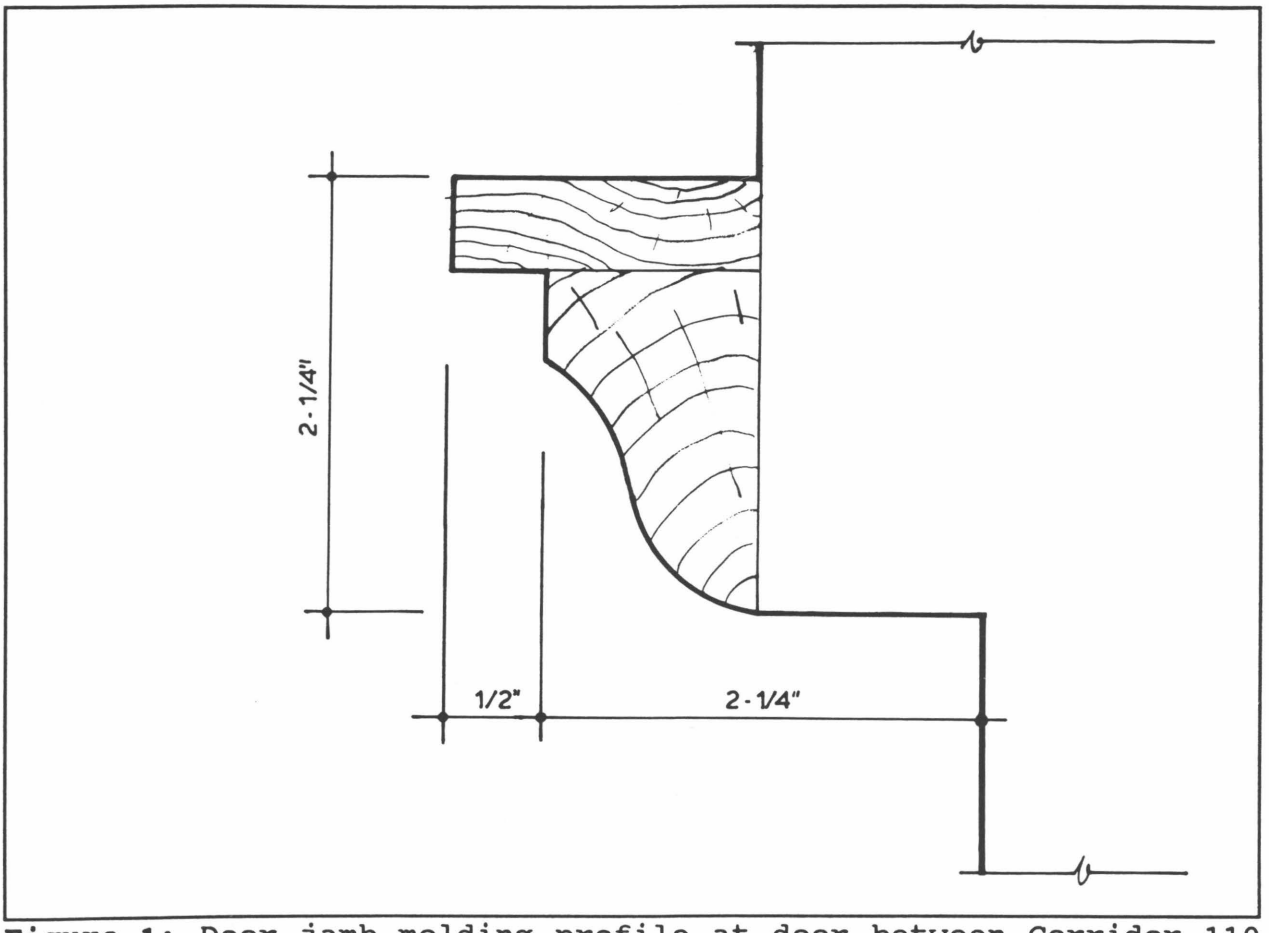


Figure 1: Door jamb molding profile at door between Corridor 110 and Equipment Room 111, Tower Connector. Full size.

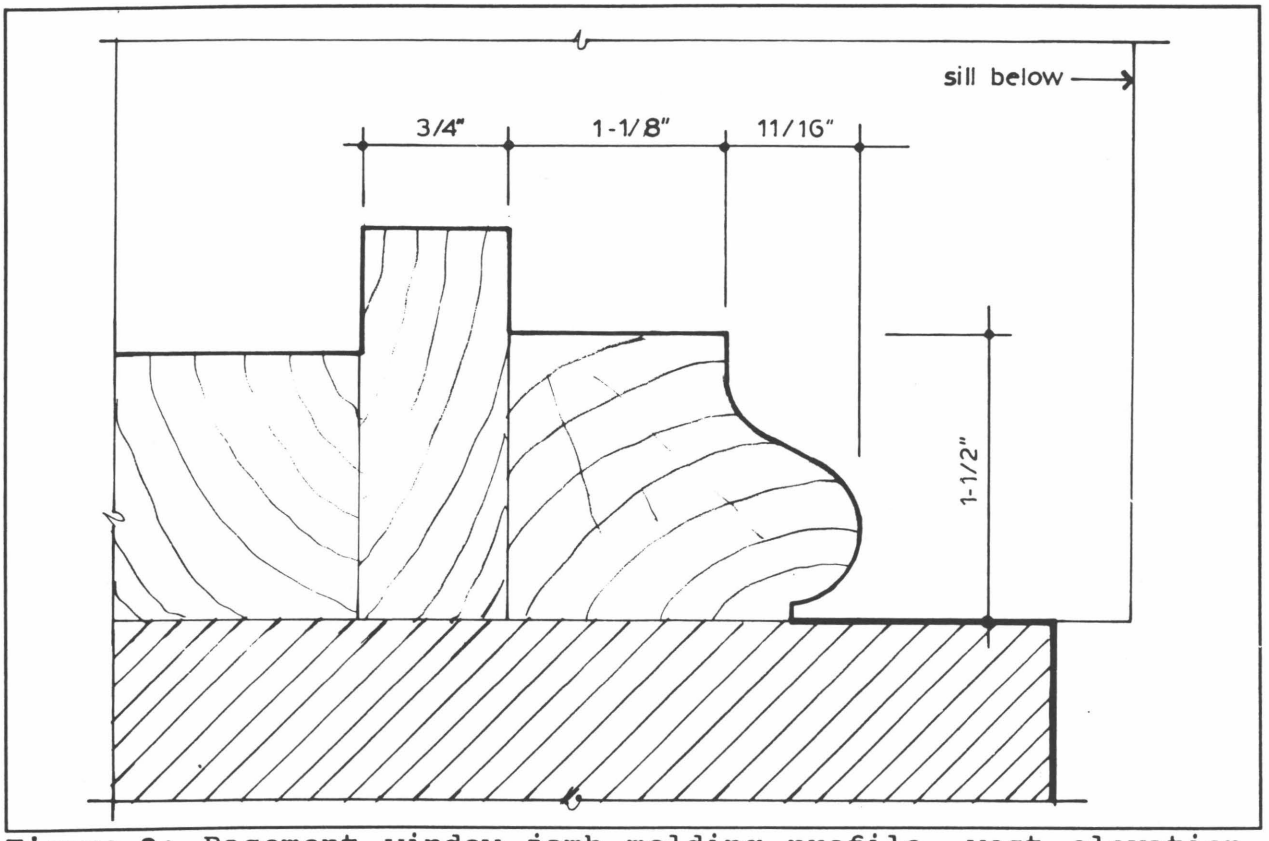


Figure 2: Basement window jamb molding profile, west elevation, north north side, Keeper's Dwelling. Full size.

APPENDIX E.

CONTRACT FOR 1797 CAPE COD LIGHTHOUSE

Between the United States of America
(Agent - Benjamin Lincoln, Collector)
and Theodore Lincoln, Esq.

(National Archives, RG 217, Records of the Accounting Officers
of the Department of the Treasury.
Civil Contracts for Lighthouse Service
June 4, 1800 - March 17, 1903,
Maine to Massachusetts, Box 003, Entry 153.)

(A)

An Estimate of the value of the materials on the spot and labour to erect a light House, other publick buildings at the Clay ponds on Cape Cod 28th February 1797

224	Tons of Stone	@ $3.50	$ 784	
	Laying Ditto & other Masons work		120	904
46	Tons of Timber		276	
40,000	Shingles		160	
30,000	boards & plank		360	
	Carpenters work		1000	
10	Spars for raising the light House & for Scaffolding		50	
	Expence of rigging & men to raise the light House		100	1946
10	Hogsheads Lime		65	
7000	Bricks		70	
120	feet of Hewed Stone for under pinning the light House		100	
	Labourers to attend the Masons, for digging the Cellar, & well & sinking the foundation of the light House & Vault		100	
	white oak planks for the top of the light House		25	
	Painting all the Buildings		300	660
	Copper covering & putting on the Copper on the top		200	
	Lantern Lamps and Stove complete		2000	
	Nails, Glass, putty, Setting &c.		90	
22	pair Hinges, locks, bolts latches & fastenings for the doors & windows, Saths, Iron for the Chimnies &c.		60	
	The expences of an over seer of the work the Stuff &c.		200	
7	Cedar Cisterns 70 Iron rods 50		120	2,670
	Articles not enumerated & a commission for doing the business			6180

Approved March 25th 1797

Signed John Adams

Articles of Agreement made & concluded at Boston in the State of Massachusetts this second day of March seventeen hundred & ninety seven between the United States of America by their Agent Benjamin Lincoln Collector of the District of Boston & Charleston on the first part & Theodore Lincoln Esquire on the second part witnesseth. That the party of the second part hereby Contracts & agrees with the party of the first, that he will truly and faithfully build a Light House on Cape Cod near the clay ponds on the land purchased by the United States of Isaiah Small in such part of S. land as the United States shall point out. That the form of the House shall be an Octagon. The foundation shall be of stone sunk five feet below the surface of the Earth, and shall be commenced twenty six feet in the smallest diameter being that perpendicular to the sides. The foundation Wall shall be three feet thick. The Octagon pyramid shall be of wood, good Oak or white Pine without sap and be twenty five feet in the outside Diameter at the base thereof. The hieghth of this wooden building from the top of the stone work or foundation shall be forty five feet, to the top of the floor of the Lantern, where the floor is to be twelve feet. The foundation shall be capped with hewn stones of at the East fourteen inches from the inner to the outer edge and sloped as far as eleven inches at the top to turn off the water.

The frame of the Pyramid shall be covered with Pine boards of one inch in thickness feather edged over which shall be laid a compleate covering of Shingles made of Cedar or White pine without sap, to be laid out in proportion as six inches is to eighteen, and to be well painted with three Coats of paint.

The Light House shall have two windows in the East and three in the west, each sash to have twelve panes of glass six by eight & hung with good Iron hinges.

On the top of the wooden work of the Pyramid shall be a strong framed tier of timber bedded thereon and projecting one foot with suitable [illegible] joists, the timber shall be twelve inches by seven in the centre and reduced to seven inches square at the extremities so as to give a proper descent from the centre to throw off the water. The whole shall be covered in the first place with good two inch white oak planks and over laid with stout sheet copper and the eave finished with a cornish. A compleate and sufficient Lantorn of six feet Diameter perpendicular to the sides in the clear and in the octagonal form, shall rest thereon, which shall be secured by eight Iron braces from the wooden frame round the Eaves of the House to the Eaves of the Lantern.

The eight corner pieces or stanchions of the Lantorn shall be well secured to the posts of the pyramid or to the tier of joists or both. These stanchions should be very stout and strong in the part below the floor & should be two & an half inches square above. The Lantern shall be eight feet high from the floor to the bottom of the dome or roof. The dome or roof shall be three feet in height. The whole space between the Posts to be occupied by the Sashes which are to be rabbited on the inside & struck solid, Each division or eighth of the Lantorn shall contain twenty one squares of glass. A part of the Sash on the South west side is to be hung with good

Iron

Iron hinges for a door to lead out on the plat form. There shall be an Iron railing fixed by the eight Iron braces of the Lantorn (three in each set) running from brace to brace all around the Gallery. The Rails shall be one inch square. The Iron rafters of the Lantorn are to be framed into an Iron hoop, over which shall be a copper funnel thro' which the smoke may go into a large copper ventilator secured from the rain by a copper covering nearly in the form of an Umbrella. Eight dormant ventilators shall be fixed in the roof. — A large curved air pipe shall be passed thro the floor, & a close stove shall be fixed in the Lantern. — There shall be five pair of stairs with a handsome rail to ascend to the Lantorn, the entrance to which shall be by a trap door completely covered with copper, as also the groove into which it shall shut. — The Light House shall be furnished with two complete electrical conductors or Rods with points. The floors are to be laid in plank. The entrance into the light house shall be well secured by a strong door hung upon iron hinges with a strong lock & latch complete. The Sills and principal timbers in the floor of the Light House shall be twelve inches square, also the foots of the Posts when worked and ten inches at the top. The Girts shall be as square as the posts at the different stories, where they enter the Posts and the whole shall be sufficiently braced with scantling four by five inches. — The second part further contracts with the first part, to build also, a framed dwelling house twenty five by twenty seven feet, one story and the roof. The Walls shall be boarded on the studs with inch pine boards feather edged, and a covering of good clap boards or shingles thereon, Cedar or Pine without Sap. — The boards on the roof are to be jointed and halved & covered with like good shingles. There shall be under the Easterly side of the House a good Cellar twenty five feet long & twelve feet wide in the clear. The wall there of shall be eighteen inches thick, & seven feet high or deep. —

The house shall be seven feet & one half stud in the clear the roof to have a right angular pitch the floors to be double above and below, the upper one to be laid in whole lengths and nailed strong. The House shall be divided into different rooms, closets and passage ways into it, as represented in the annexed plan. The place and form of the chimnies & oven shall be made conformable thereto as well as in placing the doors & Windows of the large rooms and one in each of the Bed rooms of twenty four squares twelve in each sash of glass six by eight and one window at each end of the garret of twelve squares of like glass both hung on good Iron hinges. Each window is to have a strong plain outside shutter with fastening & hinges. The Doors are to be hung and finished completely. The ceiling and inner sides of the House are to be plastered with good lime mortar, and in like mortar the bricks of the chimney shall be laid. All the wooden work inside and out shall be well painted and the whole shall be finished in a plain and decent manner with seasoned stuff. —

The party of the second part further contracts with the party of the first, to sink and stone up an oil vault, sixteen feet by twelve feet in the clear arched over and covered with earth or sand, over which a shed shall be built, and that it shall be furnished with seven strong Cedar Cisterns with covers capable of containing two hundred gallons each. The entrance to the

the Vault shall be secured by a strong door. A well shall be sunk near the House and properly stoned up & furnished with a Curb, Bucket, Windlass & Rope complete. Also a small framed Barn shall be built near to the Dwelling House of fifteen feet square and ten feet studd. The Barn shall be well boarded on the walls and roof, & the roof to be well shingled with shingles of the quality provided for the other buildings, — And the said Theodore Lincoln further contracts with the party of the first part, that he will procure and pay for all materials, labor, workmanship, Provisions and other objects of charge or expence for the sum of six thousand five hundred Dollars to be paid to him; and will execute the before directed work and every part thereof in a good and workmanlike manner on or before the fifteenth day of November next. —

The United States by their Agent aforesaid contract & agree to pay to the said Theodore Lincoln for his performance of the above stipulations on his part the sum of six thousand five hundred Dollars in three different equal payments, one third in hand, one third on the first of June next and the remainder when the Business shall be completed. —

APPENDIX F.

CONTRACT FOR ALTERATIONS TO LIGHTHOUSE, 1812

Between Henry A.S. Dearborn, Deputy Collector and Winslow Lewis

(National Archives, Waltham Branch, RG 26,
Letters Received by Boston Collector,
Contract in Lighthouse Letters, Microfilm Reel 94/4)

Articles of Agreement entered into this seventeenth day of June, Anno Domini, Eighteen hundred and twelve, between Henry A. S.t Dearborn, Deputy Collector for the district of (Boston & Charlestown) in behalf of the United States, on the one part and Winslow Lewis, of Boston, in the County of Suffolk, in the Commonwealth of Massachusetts, Gentleman, on the other part, Witnesseth, that the said Winslow Lewis on his part, hereby agrees & engages to take the

the Light House on Cape Cod, as it now stands, to make the following alterations, to wit: to cut off seventeen feet from the top of said Light House, and put on it thereafter a deck, made of timber sufficiently strong to support a new Lantern, and to be covered with three inch plank, and then sheathed with Copper. Said deck to rise, six inches in the center, and project eight inches from the side of the building. - to make and put on to the deck of said Light House, a new Lantern of the following dimensions & materials, viz: The Lantern to be of an Octagon form, ten feet high from the deck to the eaves; in each side of the Lantern eighteen sashes, fourteen inches square, the sashes to come within two feet of the deck; and the remainder of the Lantern to the deck to be covered with Copper. the posts of the Lantern to be two inches square at top, & two & a half inches at bottom of the Lantern. the posts to be run down six feet below the deck, and fasten to a timber twelve inches square framed into the building for that purpose. A door two feet wide and four feet high in one of the sides of the Lantern, made with an iron frame & covered with Copper. the Roof or the Dome of the Lantern to project from the side six inches, to be framed with sixteen iron rafters to meet in the centre in an iron hoop, eight inches wide, to be covered with heavy Copper. On the top of the Roof or dome there must be a Copper Globe as a Ventilator, two feet six inches in diameter, with a Vane of iron or Copper on the Globe, sufficiently large to turn it; the Lantern to be glazed with the best double glass of the Boston Glass House manufacture. An iron Railing on the outside of the Lantern on the outer edge of the deck four feet high, the supporting posts of which to be ten feet high, the top of which are to be bolted to the top hoop of the Lantern, each post to be one & a quarter of an inch square. The new woodwork of the building on the outside to be covered with two good Coats of paint, and the whole of the Lantern & iron railing to be painted inside and out twice over. All the aforesaid alterations & work to be made & finished in a workmanlike manner on or before the first day of July next, for the consideration of the sum of two thousand dollars. And the said Henry A. S. Dearborn, in

The said United States engages on his part to pay the said Winslow Lewis the aforesaid sum of two thousand dollars in the manner following, to wit: One thousand dollars when the Contract & the Bond for the faithful performance thereof have been signed by said Lewis and the other One thousand dollars when the said Lewis shall have completed said alterations in conformity with the foregoing Agreement: Provided that no Member of Congress shall be concerned or interested in this Contract.

In Witness whereof the parties have hereunto interchangeably set their hands & seal the day & date above mentioned.

Signed & sealed
in presence of
Wm Rawson
Andw Hamer

(Signed) Winslow Lewis (Seal)
H H Dearborn (Seal)
Collector

This may Certify that by order of the Superintendent of Light Houses for Massachusetts I have examined the Light House on Cape Cod fitted up by Winslow Lewis on his new plan and find it executed agreeable to Contract and in a workmanlike manner.

(Signed) John Foster Williams

APPENDIX G.

CONTRACT FOR THE CONSTRUCTION OF THE SECOND CAPE COD LIGHT, 1831

Between David Henshaw, Collector, in behalf of the United States of America and Winslow Lewis

(National Archives, RG 26, Lighthouse Contracts, Contract Book E, p. 259-62)

July 22d 1831.

Winslow Lewis

Contract Light-Vc.

Cape Cod — L 4023. —

Recorded in Contract book

E. page 259. 260 261. 262

Cape Cod

REPRODUCED AT THE NATIONAL ARCHIVES

Light-House upon Cape Cod

Articles of Agreement entered into this Twenty Second day of July in the year of our Lord One Thousand eight hundred and thirty one between David Hinsdale Collector for the District of Boston and Charlestown, in behalf of the United States of America, on the one part, and Winslow Lewis of Boston in the Commonwealth of Massachusetts, on the other part, Witnesseth: That the said Winslow Lewis on his part agrees & engages to build a Light House and Dwelling House at Truro, Cape Cod, of the following dimensions and description, viz. The Tower of the Light house to be of hard brick, octagon form, round. The foundation to be sunk as deep as necessary to make the whole solid base, to be laid in good lime mortar. The height of the tower to be thirty feet from the surface of the ground. The diameter of the base to be twenty two feet and the top twelve feet. Thickness of the walls at the Base to be three and a half 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 feet in diameter, four inches thick, the joints filled in with lead, 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 walls is to be white-washed twice over. There are to be three windows in the tower, of twelve lights each, of ten by eight glass, strong frames and a door five feet by three feet, made of double inch boards, cross-nailed, with substantial hinges, lock and latch. The sill, posts and cap of the door to be of stone. 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 [redacted] the entrance of the scuttle to be an iron ladder, with steps two and a half inches wide. 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 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 New England Glass 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 thumb button. The top to be a dome formed by sixteen iron rafters concentrating in an iron hoop two 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 ventillator, 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 ventillator & vane to be framed with iron, covered with Copper and painted black. Around the Lantern to be an iron railing, the posts of

REPRODUCED AT THE NATIONAL ARCHIVES

materials, dimensions and description, viz. The Tower of the Light house to be of hard brick, thirty feet round. The foundation to be sunk as deep as necessary to make the whole fabric secure, to be laid in good lime mortar. The height of the Tower to be thirty feet from the surface of the ground. The diameter of the base to be twenty two feet, and the top twelve feet. Thickness of the walls at the Base to be three and a half 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 feet in diameter, four 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 white-washed twice over. There are to be three windows in the tower, of twelve lights each, of ten by eight 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 sill, posts and cap of the door to be of stone. 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 [illegible] post; the steps and floors 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 wide. 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 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 New England Glass Manufactory. In one of the octagons to be an iron framed door covered with copper, four feet by two in the clear, to shut light into the rabbets, with a strong two button. The top to be a dome formed by sixteen iron rafters concentrating in an iron hoop six 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 ventillator, 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 ventillator & vane to be framed with iron, covered with copper and painted black. Around the lantern to be an iron railing, the posts which to be one and three eighths of an inch square, connected by three railings three quarters of an inch square, the upper one to be four feet from the deck. The lantern and wood work of the tower to be painted twice over with white lead, except the dome which is to be black. The light house to be furnished with one complete electrical conductor of copper, three quarters of an inch in diameter, with points. The Dwelling House to be of brick, twenty six feet front by twenty eight deep, one story, eight feet in the clear, a cellar under the whole, with outer doors and steps leading to it. The walls of the cellar and house to be twelve inches thick, the roof rectangular. The house to be divided as follows,

REPRODUCED AT THE NATIONAL ARCHIVES

follows: in front a room 14 feet square, an entry 4 feet wide in front of the chimney, a bed-room 8 feet by 9; a chimney in the centre of the house. In the back part a kitchen 15 ft. by 12; a bed-room 8 ft. by 9, and a pantry 5 feet by 8; between the front bed room and kitchen, to the right of the chimney, to be stairs leading to the chambers with doors to communicate with the front entry and kitchen; a fire place in the front room and one in the kitchen, with closets fitted to the chimney. The chambers to be partitioned off and lathed and plastered, double floored and well nailed. The inside wall and ceiling to be lathed and plastered; to be three windows in the front room, one window in the front bed-room, one window in the back bed-room, four windows in the kitchen, one window in the pantry, opposite the stair way and two in each of the chambers; each window on the lower floor to contain sixteen lights, and the chamber windows twelve lights of ten by eight glass. All the stuff to be sound and well seasoned; the roof to be shingled with good pine shingles. Five doors, which are to be two in the front room, one from the front bedroom and one from the back room, one from the pantry, one to the stairs which are to lead into the cellar from the outside of the house (and which stairs are to be of plank), one to each of the chambers, two to the stairway and the two outer doors, front and back, to be four panelled, except the front door which is to be a glazed door, to have good hinges and thumb latches, the front outer door to have a good lock. On one side of the chimney in the kitchen to be an oven of suitable size with cast iron doors. The kitchen fire place to be furnished with an iron crane, ramming and hook, a good hearth to be built in the kitchen with a gutter to lead through the brick wall. The roof of the house to have gutters and spouts to lead off the water. The out house five feet by four, boarded & shingled. All the wood work, except the roof, inside & out, to be painted three coats over. A well to be sunk in the cellar sufficiently deep to procure good water, if practicable to be stoned or bricked, and fitted with a Cast iron pump, to stand on the sink in the kitchen. The Light House to be furnished with eight double tin oil cans, to hold ninety gallons each; eight wooden horses, two spare lamps; one lantern Cannister and iron rivets, one tube box, one wick box, one oil Carrier, one glazier's diamond, one torch, one hand lantern and lamp, two pair scissors, two files, two tube cleaners, one stove and funnel, one oil feeder, and all the necessary apparatus, in the same manner as Light Houses of the United States have been fitted up by Winslow Lewis with the addition of apparatus for conducting the heat of the lamps to the oil therein. The whole - the buildings and fitting up - to be completed by the middle of November next, to be done and finished in a workmanlike manner for the sum of Thirty nine hundred and ninety three dollars, including both the buildings and fitting up the Light.

And the said David Henshaw, in his capacity aforesaid, agrees and engages on his part to pay to said Winslow Lewis the sum of Thirty nine hundred & ninety three Dollars, when the whole of said work shall have been completed in conformity to this foregoing agreement, and approved by the Superintendant of the establishment, provided that no member of Congress shall be concerned in this contract nor interested therein.

REPRODUCED AT THE NATIONAL ARCHIVES

room, one window in the back bed-room, four windows in the Kitchen, one window in the pantry on opposite the Stair way and two in each of the Chambers; each window on the lower floor to contain sixteen lights, and the chamber windows twelve lights of ten by eight glass. All the timber to be sound and well seasoned; the roof to be shingled with good pine shingles. The doors, which are to be two in the front room, one from the front bedroom one from the back bedroom, one from the pantry, one to the stairs which are to lead into the cellar from the inside of the house (and which stairs are to be [illegible]), one to each of the chambers, two to the stairway and the two outer doors, front and back, to be four pannelled, except the front door which is to be a frieze door, to have good hinges and thumb latches, the front outer door to have a good lock. On one side of the chimney in the kitchen to be an oven of suitable size with an iron door. The kitchen fire place to be furnished with an iron crane, hammel and hook, a good sink to be built in the kitchen, with a gutter to lead through the brick wall. The roof of the house to have gutters and spouts to lead off the water. The out house five feet by four, boarded & shingled. All the wood work, except the roof, inside & out, to be painted twice over. A well to be sunk in the cellar sufficiently deep to procure good water in the sink in the kitchen. The Light House to be furnished with eight double X tin oil butts, to hold ninety gallons each; eight wooden horses; two spare lamps; one lantern Canister and iron hoist, one tube box; one wick box; one oil carrier, one glaziers diamond one hook, one hand lantern and lamp; two pair scissors; two files; two tube cases; one stove and funnel; one oil feeder, and all the necessary apparatus, on the same manner as Light Houses of the United States have been fitted up by Winslow Lewis with the addition of apparatus for conducting the heat of the lamps to the oil there. The whole - the buildings and fitting up - to be completed by the middle of November next; to be done and finished in a workmanlike manner for the sum of Thirty nine hundred and ninety three dollars, including both the buildings and fitting up the Lights.

And the said David Hoskins, in his capacity aforesaid, agrees and engages on his part to pay to said Winslow Lewis the sum of Thirty nine hundred & ninety three Dollars, when the whole of said work shall have been completed in conformity to the foregoing agreement, and approved by the Superintendant of the establishment, provided that no member of Congress shall be concerned in this contract, nor interested therein.

Signed & Sealed in Presence of

Jeslaven Horton

Samuel F. Allen

David Hoskins Collector

Winslow Lewis

REPRODUCED AT THE NATIONAL ARCHIVES

APPENDIX H.

REPORT OF LIEUT. EDWARD W. CARPENDER, U.S.N., 1838

(National Archives, RG 26, Lighthouse Clipping Files)

REPRODUCED AT THE NATIONAL ARCHIVES

(Highlands, Truro.)

Report of Lieut. Edward W. Carpender, U.S.N.
New York, November 1, 1838.

x x x x x

Doc. Rel. to Lt.-hse.

1789–1871.

p. 186.

Cape Cod light.—This great and important light stands nine miles to the eastward of Race point, on the high land of Truro, 160 feet above the level of the sea. It consists of 15 lamps, with 15-inch reflectors, in two circular series, 8 in the lower and 7 in the upper. These lamps are so arranged as to be seen from Boston bay as well as the sea. I noticed one of the lamps, in the lower series, to be fronting the iron door of the lantern; of course, to no useful purpose. It should be removed to the upper series, where there is room enough for it. These reflectors are from one to two inches apart, while (without any apparent reason for it) there are ten inches between two of them. I recommend, as at Long Island head, the removal of these reflectors, so that all the lamps in the lantern may be seen from all points of the compass—an effect which cannot be produced while the reflectors intercept the light of half the lamps.

I visited this light a few minutes before sundown, and found the keeper (alarmed at the sight of the revenue cutter) stolen into his lantern to make a hasty rub-up against the expected visit. Time did not admit of the necessary preparations being made before the hour of lighting. But few of the lamps were trimmed. Such chimneys as had been touched were imperfectly cleaned. The reflectors had no appearance of having been recently burnished, and the glass of the lantern was smoked. This light, on account of its magnitude and elevation, would, if properly kept and attended, illuminate this whole coast all the way down to Chatham, a distance of 25 miles; at all events until it intersected that light, which is itself 70 feet above the level of the sea.

This tower is of brick, 30 feet high. The walls, at the base, are 3½ feet thick—one-third more than the walls of the stone tower at Clark's point, which is 10 feet higher. The interior width at the base is 15 feet, two feet more than that tower. The finishings (as steps, doors, sills, &c.) are of wood, exhibiting, though only built seven years, some signs of decay.

This lantern is eight feet high, two feet higher than is necessary. The glass, 12 by 14, is of a better quality than any yet observed. Premises in good order.

APPENDIX I.

REPORT OF I.W.P. LEWIS, C.E., BY ORDER OF HON. W. FORWARD, SECRETARY OF TREASURY, 1842

(National Archives, RG 26, Lighthouse Clipping Files)

REPRODUCED AT THE NATIONAL ARCHIVES

Report of I.W.P. Lewis, C.E., by order of Hon. W. Forward, Sect'y of Treasury, on the condition of the lt-hos., &c., coasts of Me., N.H., & Mass., in 1842.

x x x x x

Doc. Rel. to Lt-hos. 1789-1871. p. 358.

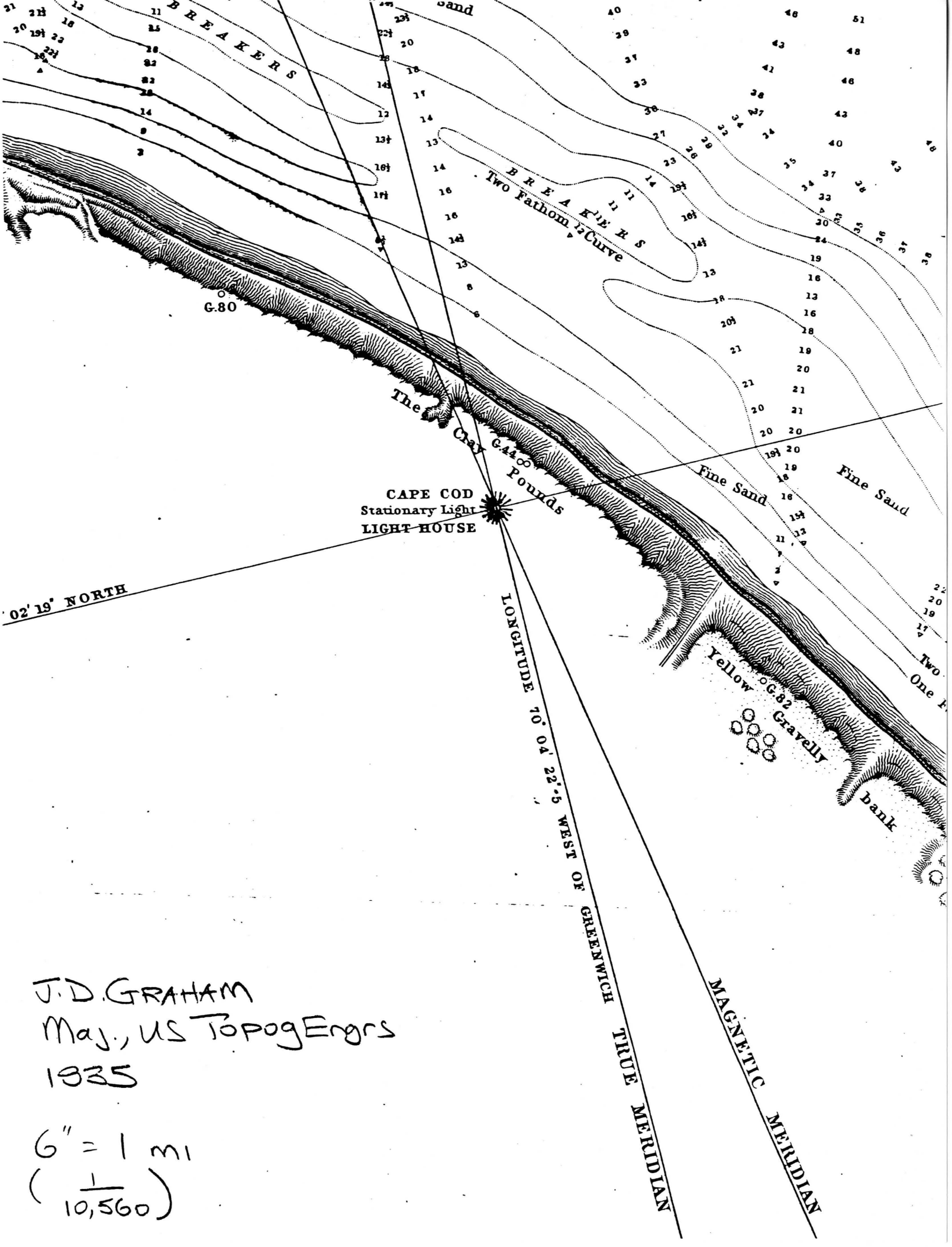
An illustration of the usual method of constructing brick light-houses is presented, showing an elevation and vertical section of the light-house at Truro, Cape Cod, which was erected by contract in 1833, at a cost of $4,162. This tower was refitted by me in 1840. It will be seen that, in the original construction, the door and window frames, of wood, were set flush with the exterior surface, and at the same angle of inclination. These, with the wooden staircase, (the ends of the steps and risers being bedded into the masonry,) were all rotten. The window frames and staircase were pulled out by hand; and the removal of the latter brought down a portion of the inner face wall, when it was discovered that the interior of the walls was laid without mortar, the brick being loosely thrown in, and the interstices filled with sand. At the base, which *rested* on the *surface of the ground*, there was found in the interior of the wall a large number of stones, thrown in to fill up and save brick. On removing the lantern, the mortar of this superstructure was found to have so little cohesion, that the masons, to save time, shovelled off the bricks; and thirteen feet of the tower were taken down in this manner, before arriving at a part that presented sufficient surface and stability to justify a reconstruction. The tower was, however, rebuilt, and rendered fire proof throughout by the introduction of cast-iron door, window frames, sashes, staircase, roof, and lantern, together with a hot-air furnace, to heat the building in winter. The door and window frames were recessed, and set perpendicularly. The newel of the spiral stairs, being a cylinder of cast iron, communicating by means of a flue, (passing out below the base of the tower,) with the external air, and receiving near its top the smoke pipe of the furnace, assists materially in ventilating the lantern during cold weather. The roof of the tower is formed of one disc of cast iron, fifteen feet in diameter, with a flange beneath, six inches deep, that shuts down over the cornice, and effectually prevents all leakage. The plinth and dome of the lantern are also each cast in one piece, the latter being supported by sixteen wrought-iron stiles, four by one inch, set edgewise to the light. There are but sixteen panes of glass in the lantern, each five feet high and two feet wide. The lamps are cast-brass Argand fountains, with $\frac{3}{4}$-inch burners; the reflectors, true paraboloids, (made on a cast-iron die, turned and polished with the utmost care,) twenty-one inches in diameter, with a focal axis of three inches, plated with twenty-one ounces of pure silver, and weighing fourteen pounds each. The burners are perfectly adjusted to the focal point, and so attached to the frame-work that the keeper has no power to alter the adjustment. The reflectors are also set truly vertical, and without the possibility of being disturbed in their positions either by carelessness or accident. The whole lighting apparatus is supported upon a massive frame of cast iron, placed in the centre of the lantern. Much animadversion has been thrown upon this construction, from the fact that it cost $5,919, which amount is contrasted with the expense of refitting by *contract* the light-house at Cape Henlopen for $3,600. In Document 811, (2d session 27th Congress, page 72,) the items of respective cost are set forth by the Fifth Auditor, in a letter to George Bancroft, Esq., endeavoring to convey the idea that the refittal was of a similar character in both cases, and that, therefore, the cost should be the same. The statement there made is not a fair exposition of the truth.

APPENDIX J.

MAP SECTION FROM "A REPORT UPON THE MILITARY AND HYDROGRAPHICAL CHART OF THE EXTREMITY OF CAPE COD, INCLUDING THE TOWNSHIPS OF PROVINCETOWN AND TRURO WITH THEIR SEACOASTS AND SHIP HARBORS, PROJECTED FROM SURVEYS EXECUTED DURING PORTIONS OF THE YEARS 1833, 1834, AND 1835"

Under the Direction of James D. Graham,
Major U.S. Corps of Topographic Engineers, 1838

(Archives, Cape Cod National Seashore, NPS)



J.D. GRAHAM
Maj., US TopogEngrs
1835

6" = 1 mi
$\left(\frac{1}{10,560}\right)$

APPENDIX K.

CAPE COD LIGHT STATION
RESERVATION SURVEY, 1885
(Printed 1886)

(Microfilm, U.S. Coast Guard Academy Library,
New London, Connecticut)

CAPE COD, MASS.

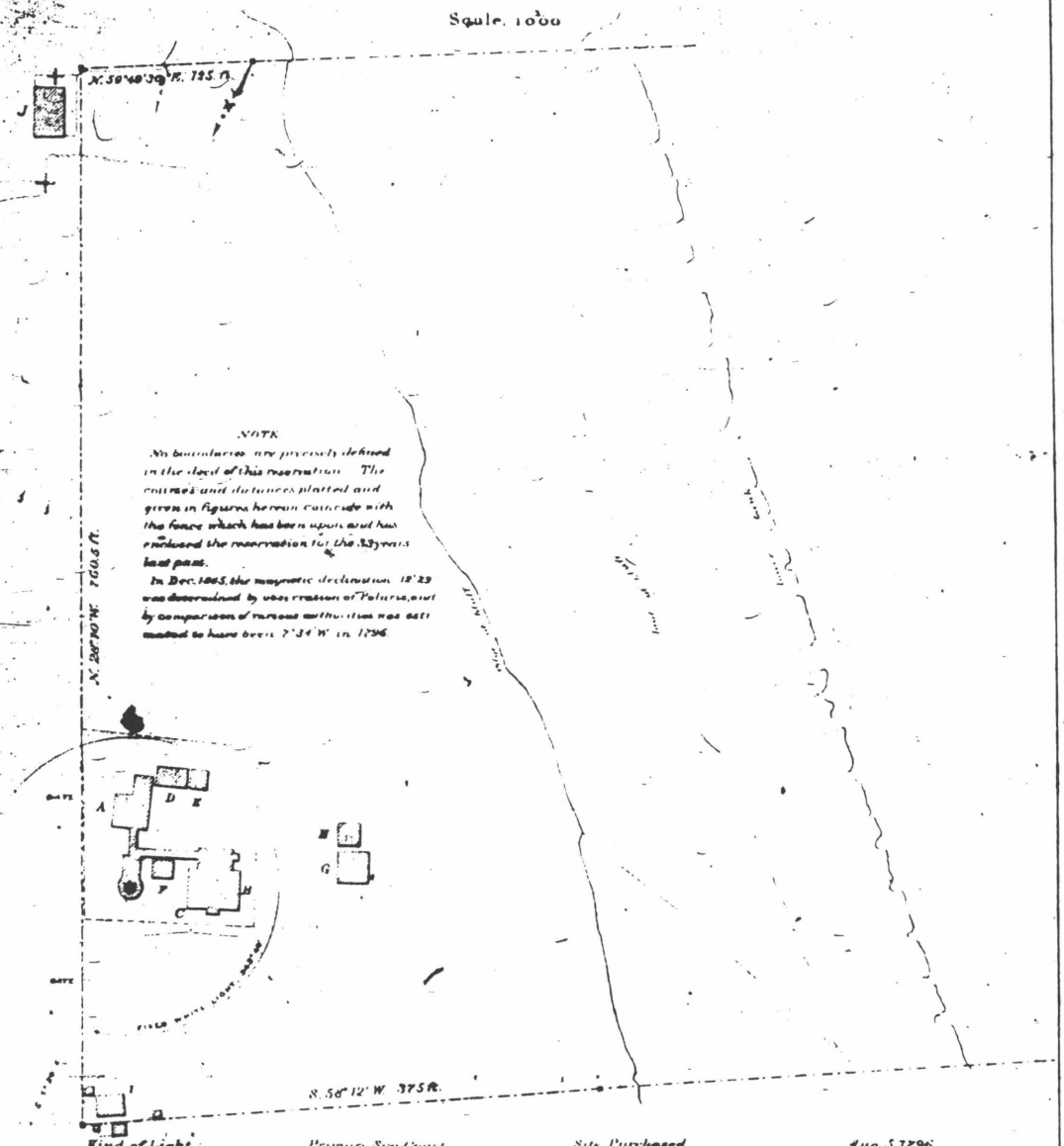
LIGHT STATION.

On the N.E. or seaward side of Cape Cod, Highlands, Truro, Mass.

Lat. 42° 2' 21" N.; Long. 70° 3' 39" W.

Reservation Surveyed Dec. 18 to 23, 1885, by E. P. ADAMS, C.E., L.H. Surveyor.

Scale, 1:600



Kind of Light	Primary Sea Coast	Site Purchased	Aug. 5, 1796.
Order of Light	1st.	Deed Recorded in Barnstable Co Reg. Book 49 p. 95.	
Characteristic of Light	Fixed White	First Buildings, when built	1797.
Base of Tower above water level	142 ft.	When rebuilt or renovated	Rebuilt, 1857.
Focal Plane " "	195 ft.	Area of Reservation in deed Nr. A. to M.H.W. 9.95 A.	
Kind of Fog Signal	1st Class Daboll Trumpet	Area enclosed, to edge of bluff	4.222 Acres.
Characteristic " "	Blasts 8 sec. intervals 30s	" " by picket fence	0.383 "

EXPLANATIONS. Mag. Dec. in 1796 (est. 7° 34'), dec. at survey 18° 39' W. Courses given on Plan are True bearings.

● Light Tower. A. Principal Keeper's Dwelling. B. First Assistant's Dwelling. C. Second Asst's Dwelling. D. E. F. Keepers' Wood Houses. G. Fog Signal House. H. Coal House. – Mean High Water Line. — — — Boundary of Reservation. Line of Fence. ○ Stone Bound, Nr. long. 6" 6 rep. cut thus: —. ▷ Stake set for True Meridian. I. Barn and Hen Houses. J. Merchant Marine Telegraph.

Feet. 0 100 200

C. J. McAuslin, L.H. Surveyor 1st & 2d Dists.

H. L. Stanton, Maj. of Engrs. Engr. 1st & 2d L.H. Dists.

US LHE

OFFICE OF L.H. ENGR., P.O. BLDG. BOSTON MASS., MAR 27, 1886.

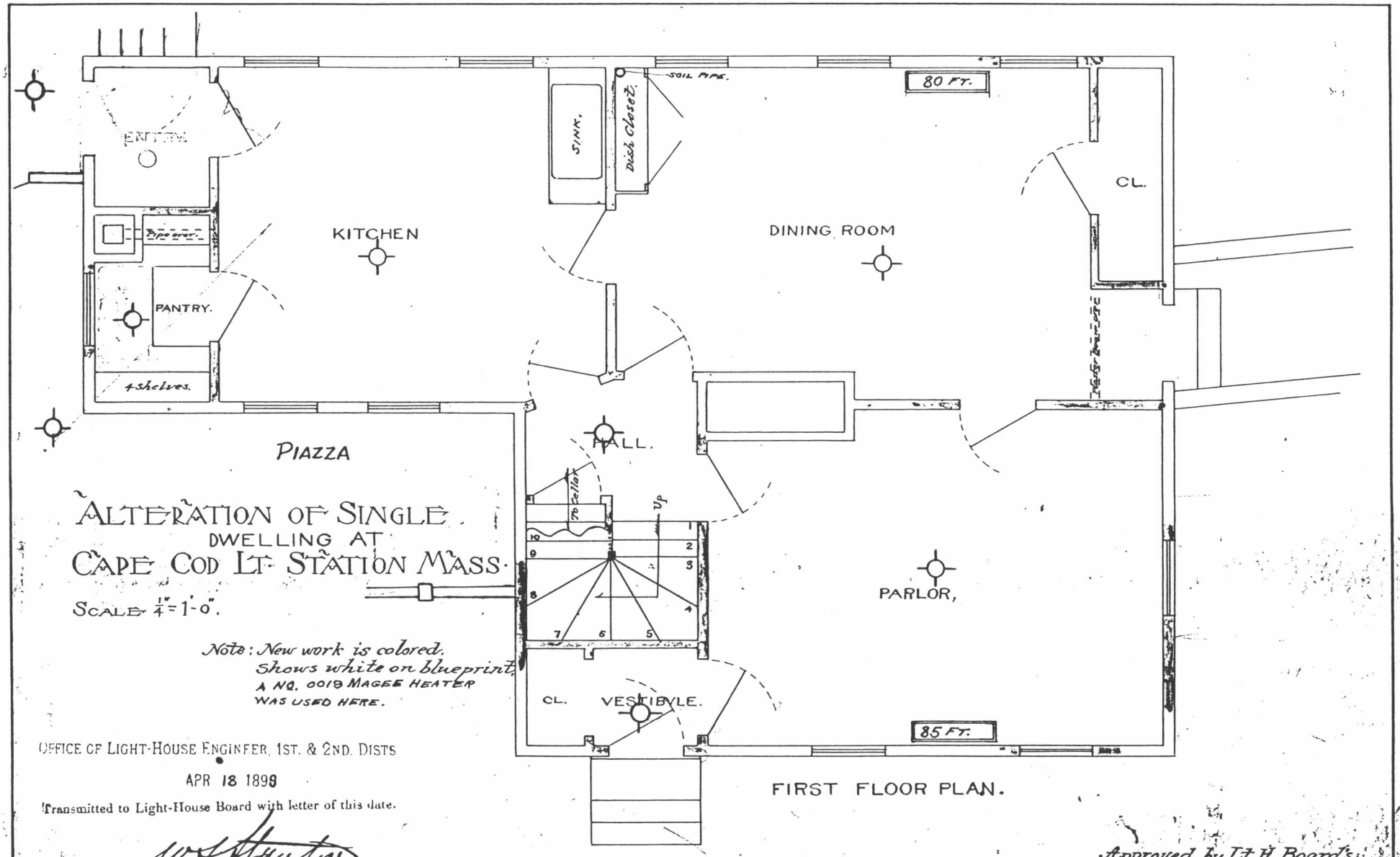
(P)

2-5C-23

APPENDIX L.

ALTERATION OF SINGLE DWELLING AT CAPE COD LIGHT STATION MASS. APRIL 18, 1899

(Archives, USCG Civil Engineering Unit Providence)



ALTERATION OF SINGLE DWELLING AT CAPE COD LT. STATION MASS.

SCALE 1/4" = 1'-0".

Note: New work is colored. Shows white on blueprint. A NO. 0018 MAGEE HEATER WAS USED HERE.

OFFICE OF LIGHT-HOUSE ENGINEER, 1ST. & 2ND. DISTS

APR 18 1899

Transmitted to Light-House Board with letter of this date.

W. H. Heuter

.....MAJ. OF ENGRS

ENGINEER 1ST. & 2ND. L. H. DISTS

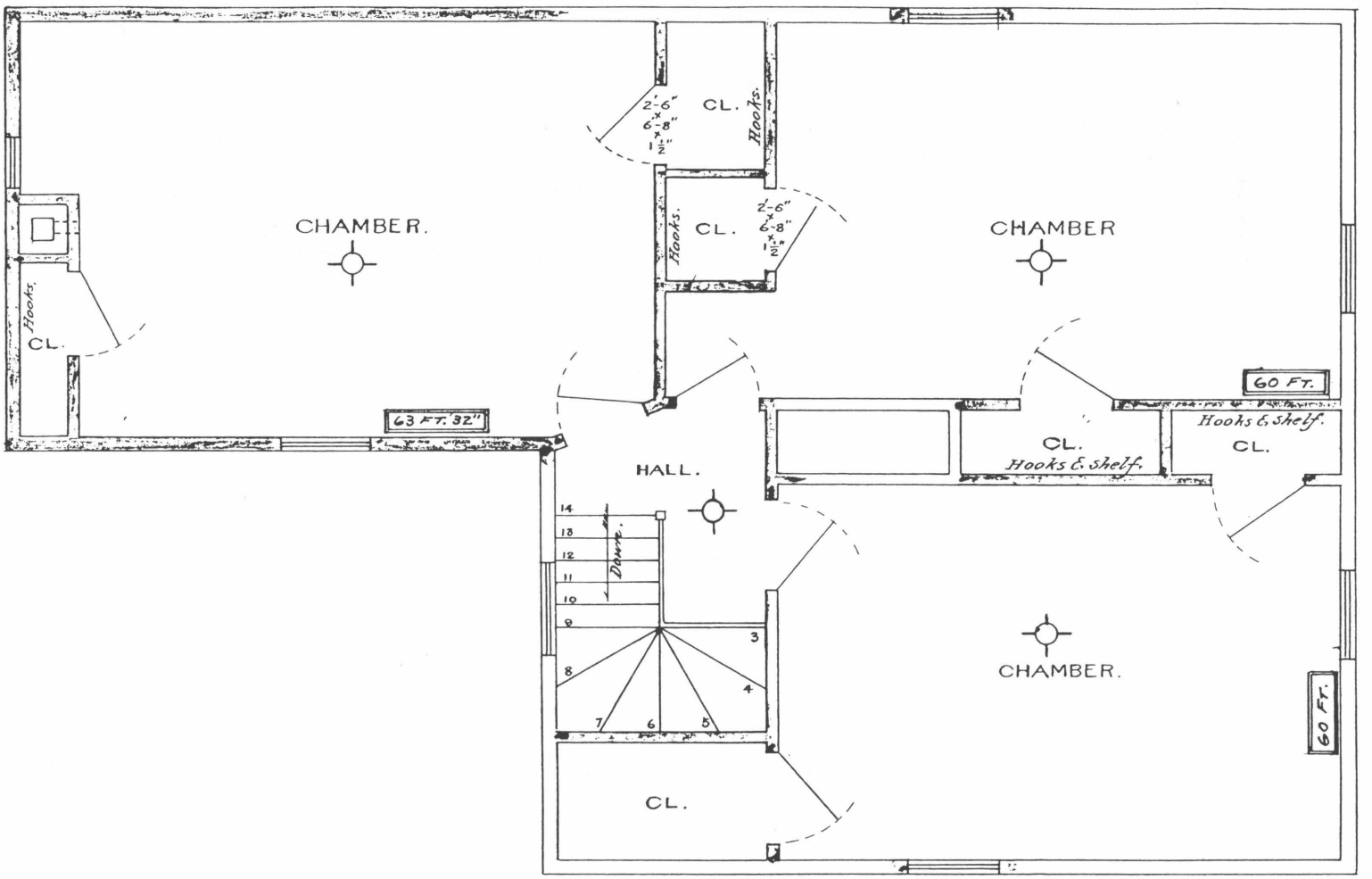
FIRST FLOOR PLAN.

Approved by Lt. H. Board's telegram 4-25-'99.

(8)

No 21) S. 38.

No. 1577 Sheet 1.



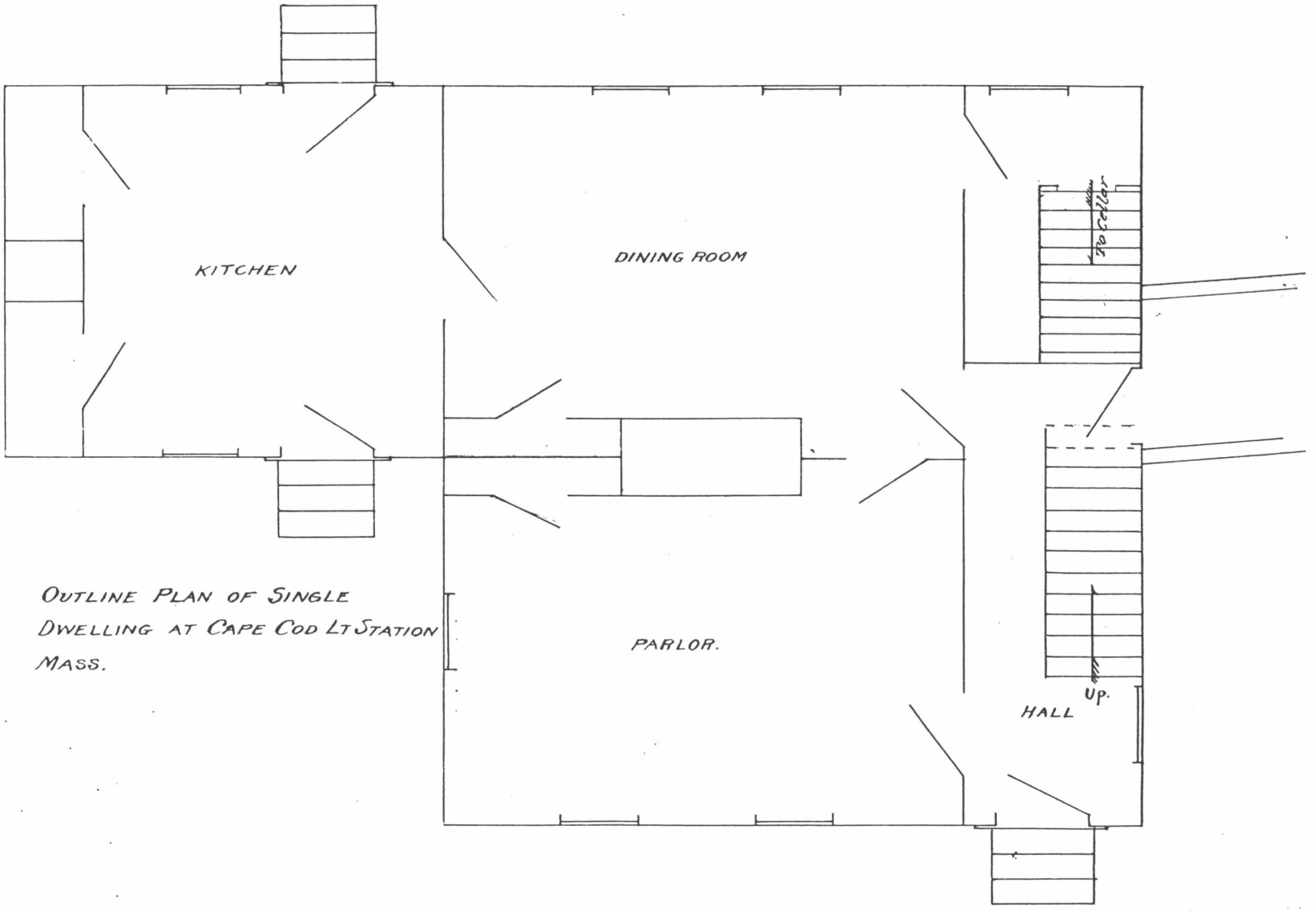
SECOND FLOOR PLAN.
SCALE $\frac{1}{4}$ = 1'-0".

CAPE COD 4/5 No 1577 Sheet



ELEVATION.
SCALE $\frac{1}{4}$" = 1'-0".

CAPE COD 4/5 No 1577

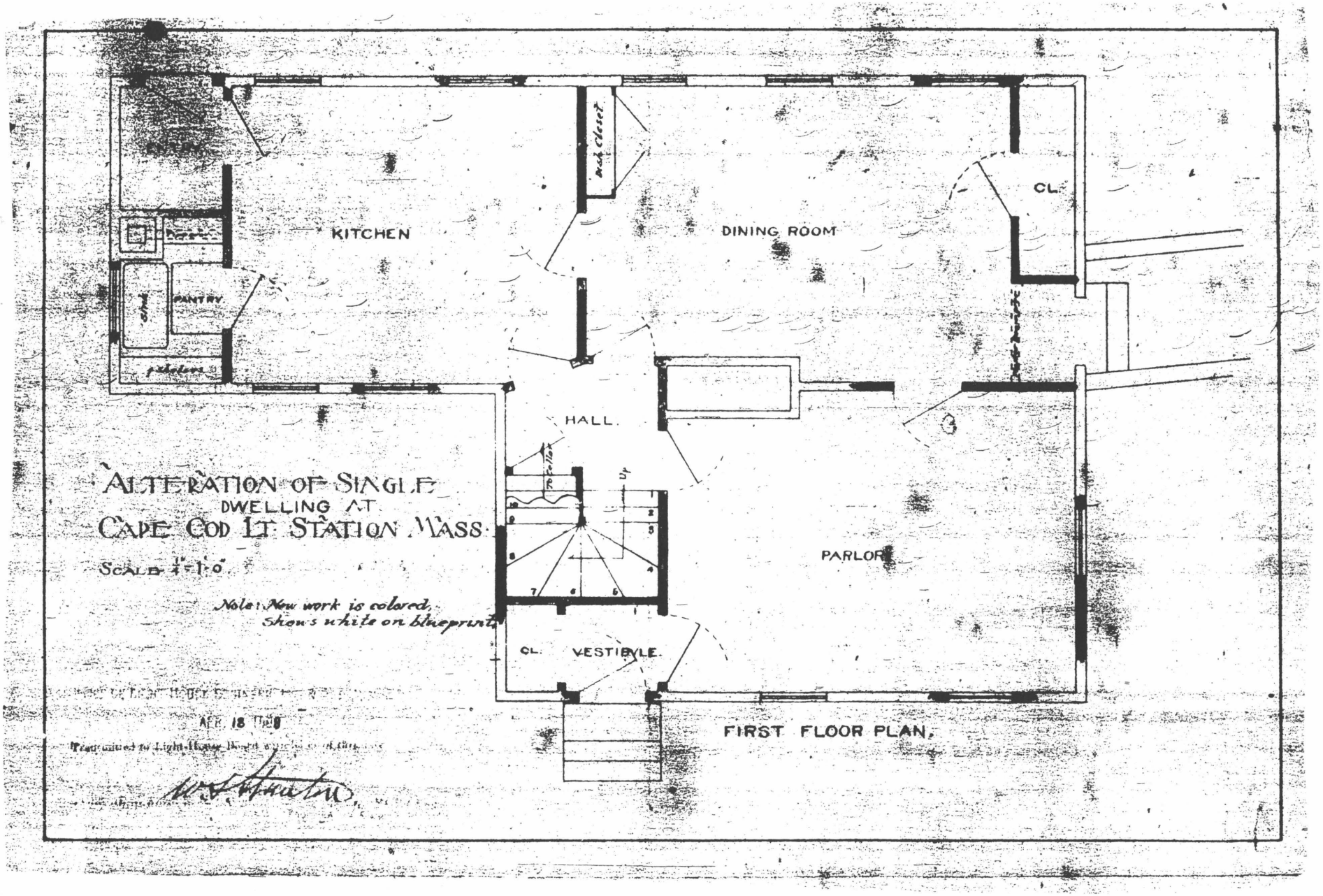


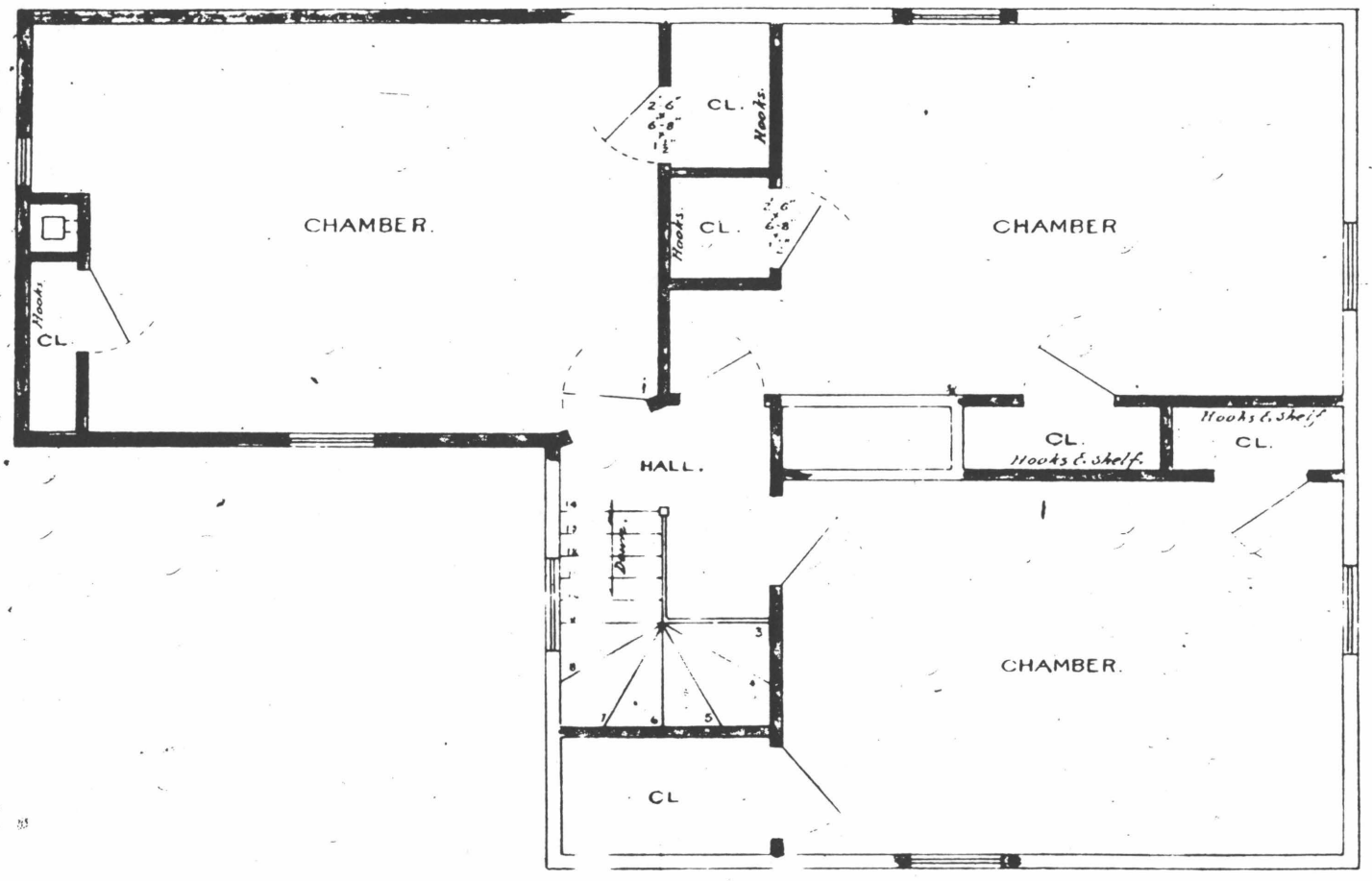
OUTLINE PLAN OF SINGLE DWELLING AT CAPE COD LT STATION MASS.

APPENDIX M.

ALTERATION OF SINGLE DWELLING AT CAPE COD LIGHT STATION MASS. APRIL 18, 1899

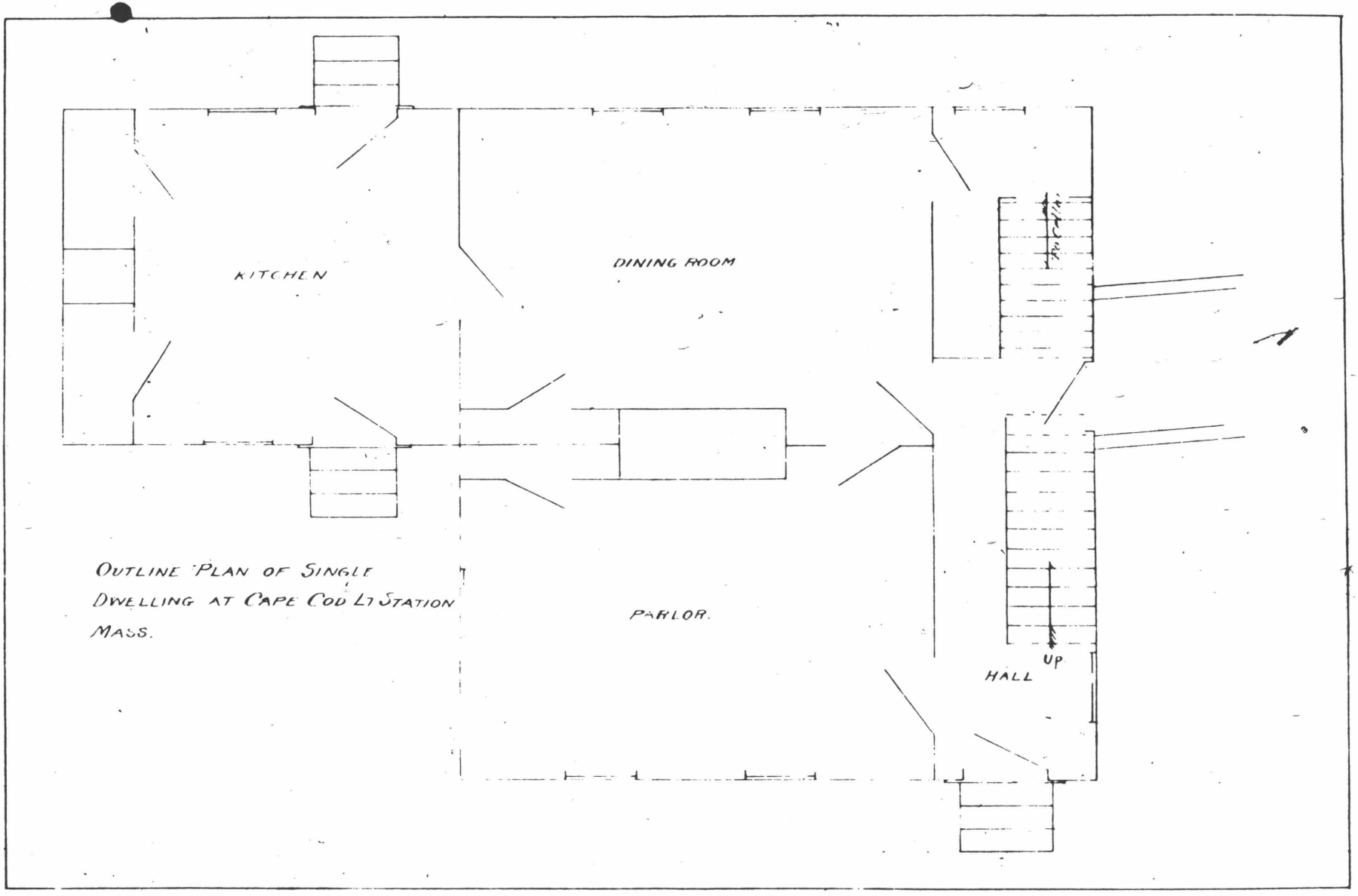
(Microtext, U.S. Coast Guard Academy Library,
New London, Connecticut)


KITCHEN
DINING ROOM
CL.
PANTRY
HALL
PARLOR
CL.
VESTIBYLE.
ALTERATION OF SINGLE
DWELLING AT
CAPE COD LT. STATION MASS.
SCALE 1"-1'-0"
Note: New work is colored,
shows white on blueprint
APR. 18
FIRST FLOOR PLAN.

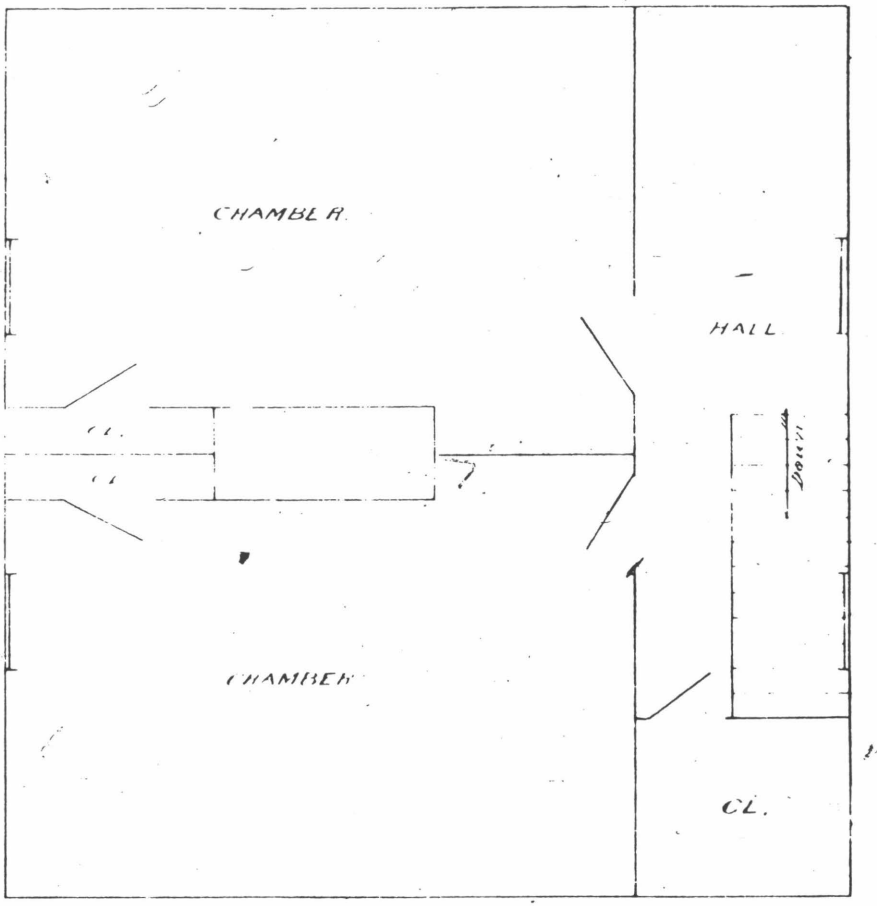


SECOND FLOOR PLAN.

SCALE ¼"=1'0".



OUTLINE PLAN OF SINGLE DWELLING AT CAPE COD LT STATION MASS.



SECOND FLOOR PLAN.

APPENDIX N.

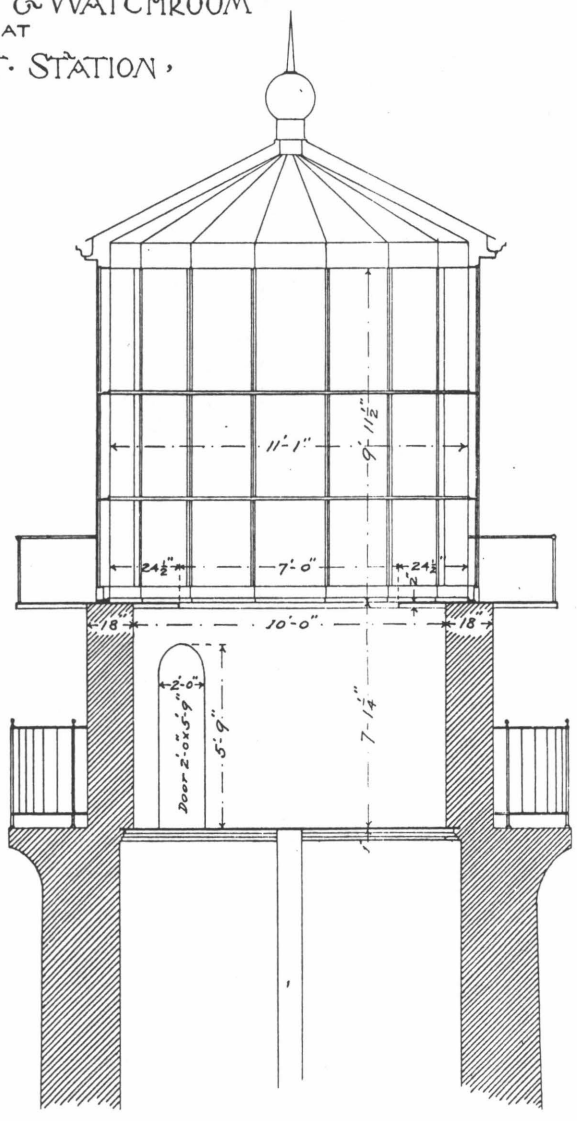
LANTERN AND WATCHROOM AT CAPE COD LIGHT STATION, CIRCA 1900

(Plate 1. - Archives, USCG Civil Engineering Unit Providence;
Sheet 1. - Mircotext, U.S. Coast Guard Academy Library)

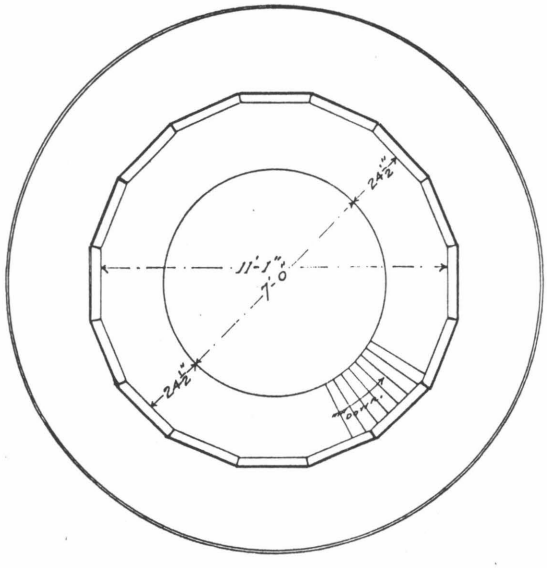
PLATE I.

LANTERN & WATCHROOM AT CAPE COD LT. STATION, MASS.

SCALE-$\frac{1}{4}$"-1'-0".



SECTION OF LANTERN & WATCHROOM.



PLAN OF LANTERN.

ACCOMPANYING SPECIFICATIONS FOR ILLUMINATING APPARATUS.

(No 12) S. 38

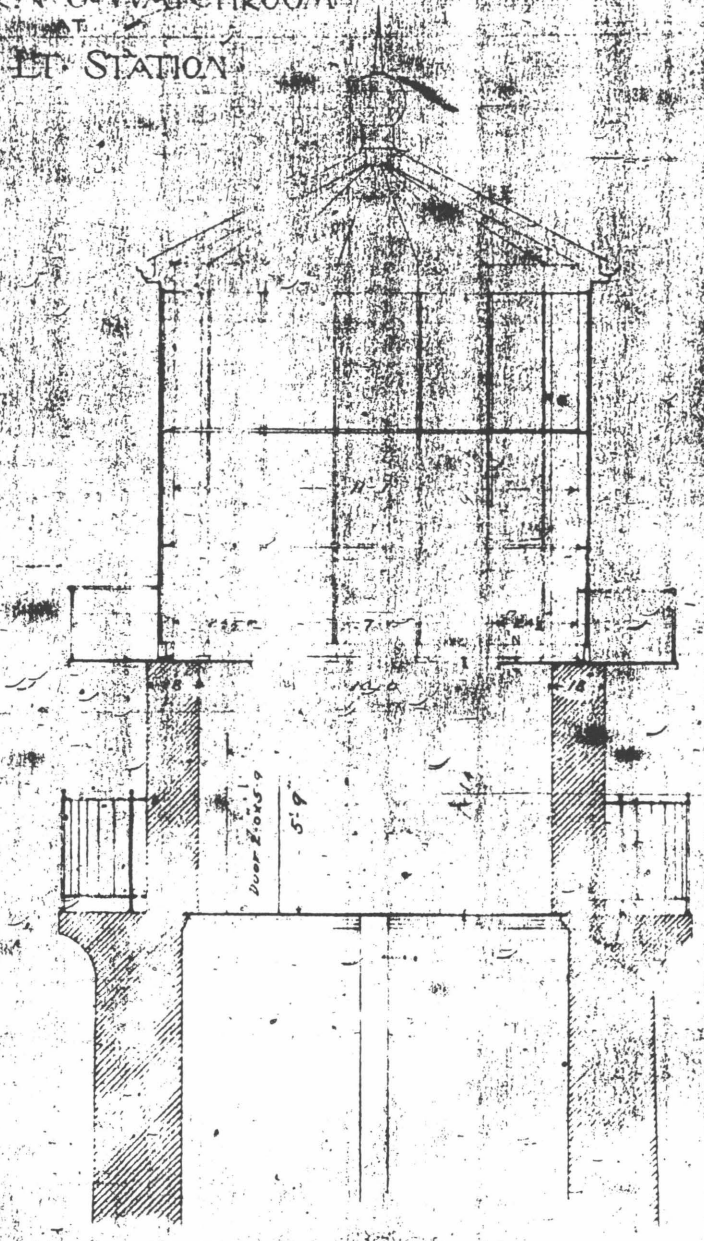
No 1569

LANTERN & WATCHROOM

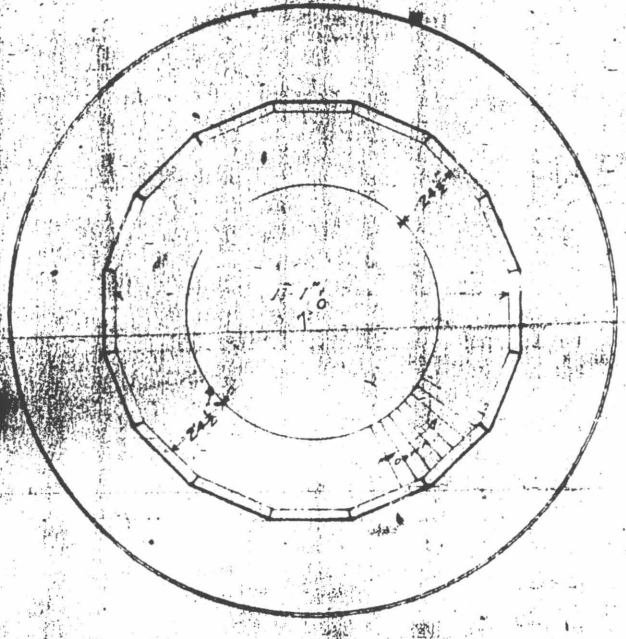
CAPE COD LT. STATION

MASS.

Scale 1/2" = 1'-0"



SECTION OF LANTERN & WATCHROOM.



PLAN OF LANTERN.

(P)

2d Dist. 3 C. with Engrs Ltr. #81. of 29 Sept. 1905 —
filed 1 Dec. —

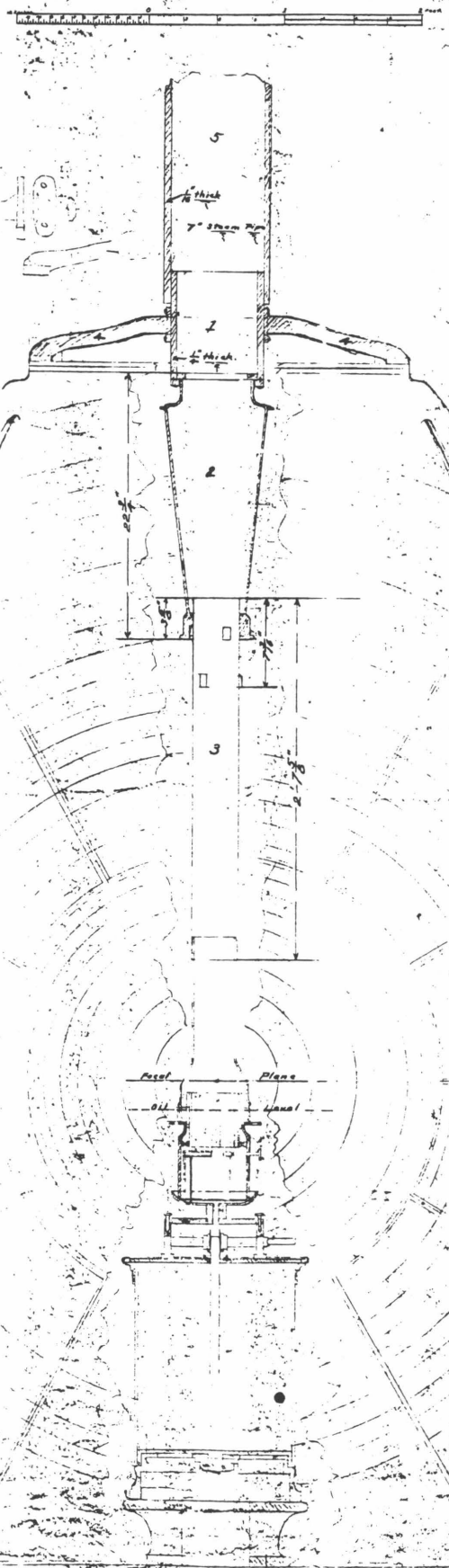
APPENDIX O.

DETAILS OF SMOKE PIPE AND SMOKE PIPE SUPPORT, 1901

(Archives, USCG Civil Engineering Unit Providence)

U.S. Light-House Machine Shop, Boston Mass., September 4, 1901.

Cape Cod 1st Class Lens. — Details of Smoke Pipe.



1 Lug Attachment. Crown Plate.
2 Connecting Tube.
3 Damper Tube.
4 Web Attachment.
5 Steam Pipe.

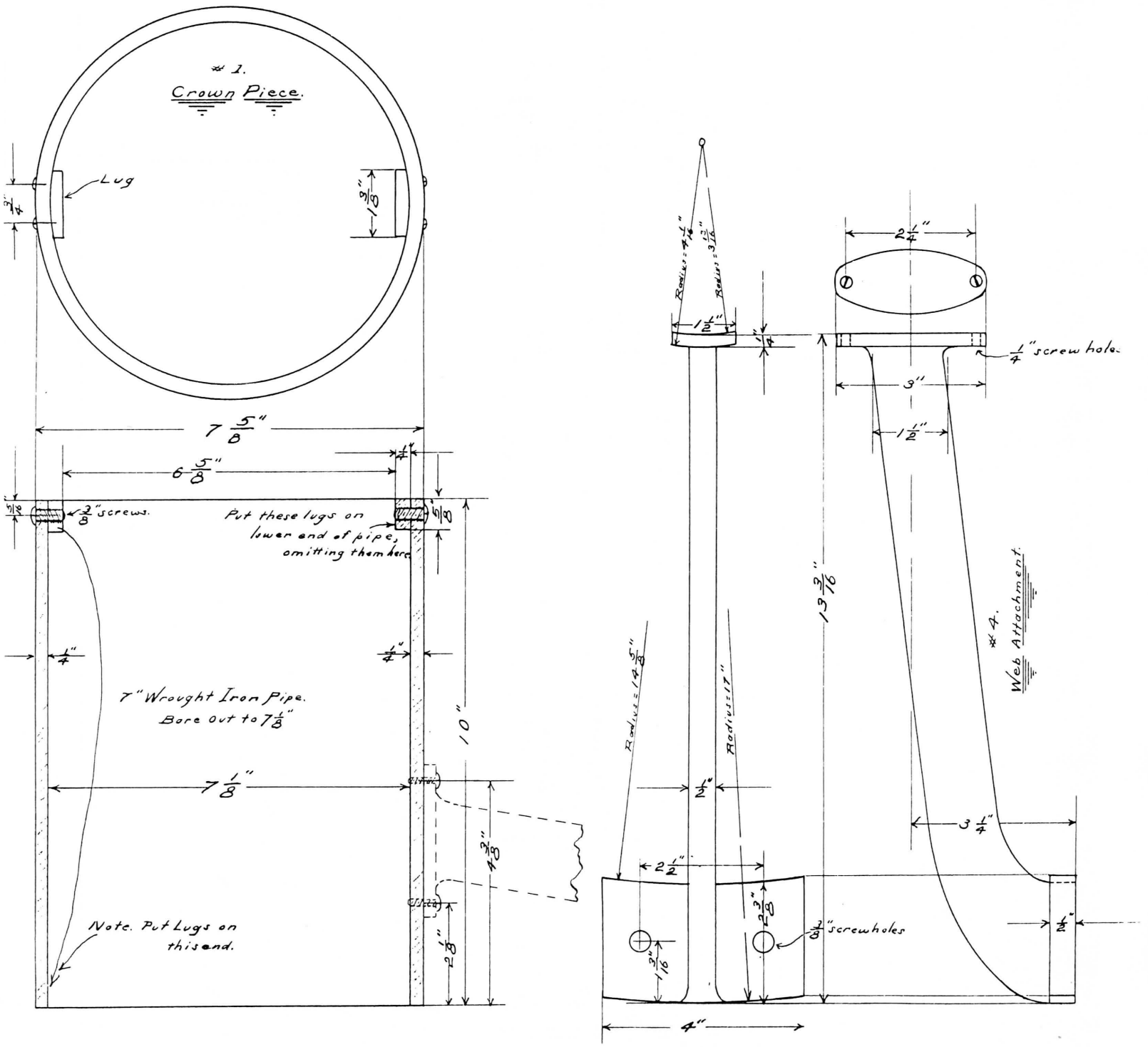
No. 1580

CAPE COD 1ST CLASS LENS

SMOKE PIPE SUPPORT.

U.S. Light-House Machine Shop. Boston, Mass. September 5, 1901.

Scale:= Half Size.

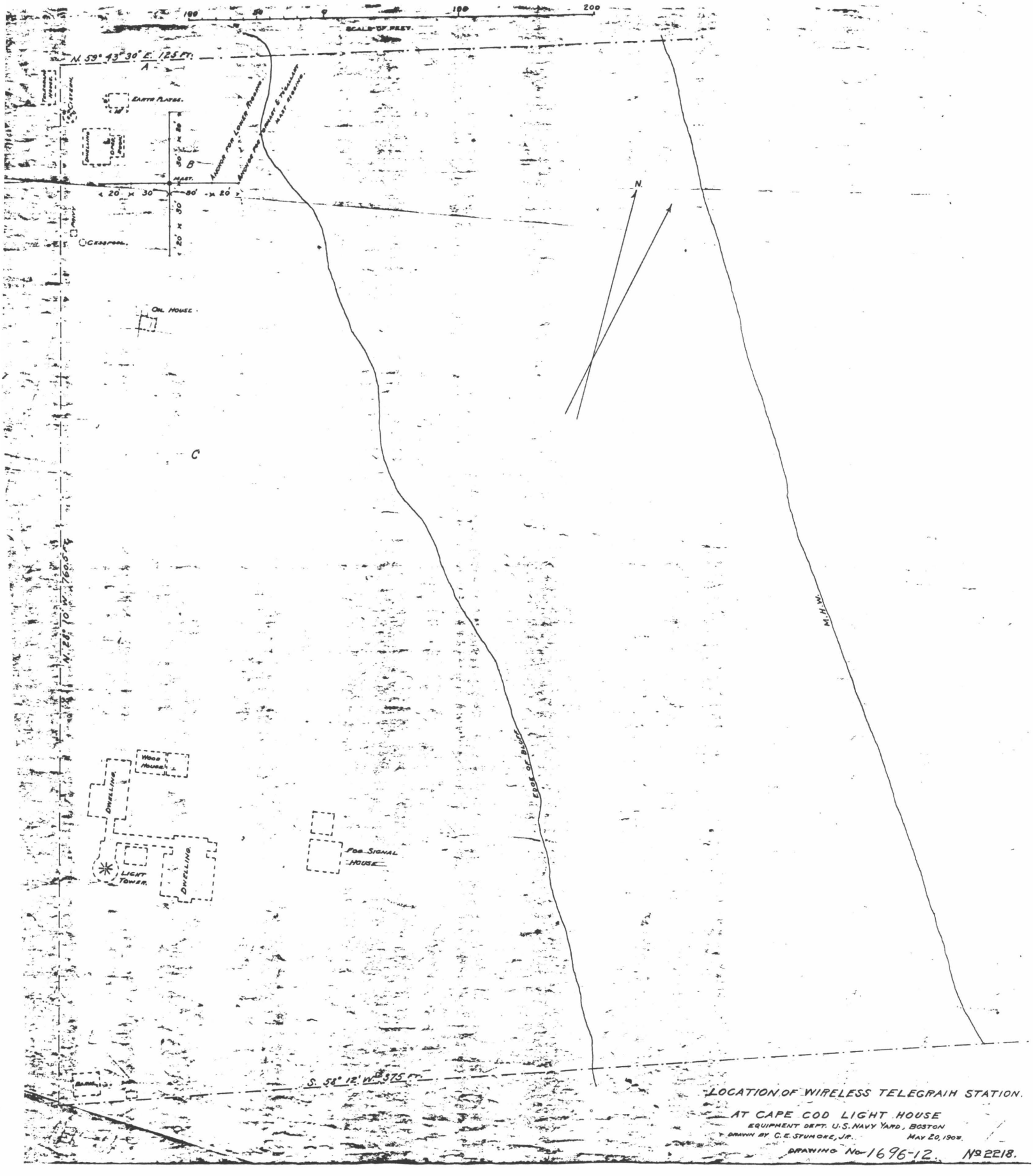


No 1579

APPENDIX P.

LOCATION OF WIRELESS TELEGRAPH STATION AT CAPE COD LIGHTHOUSE, 1903

(Archives, USCG Civil Engineering Unit Providence)



LOCATION OF WIRELESS TELEGRAPH STATION.

AT CAPE COD LIGHT HOUSE

EQUIPMENT DEPT. U.S. NAVY YARD, BOSTON

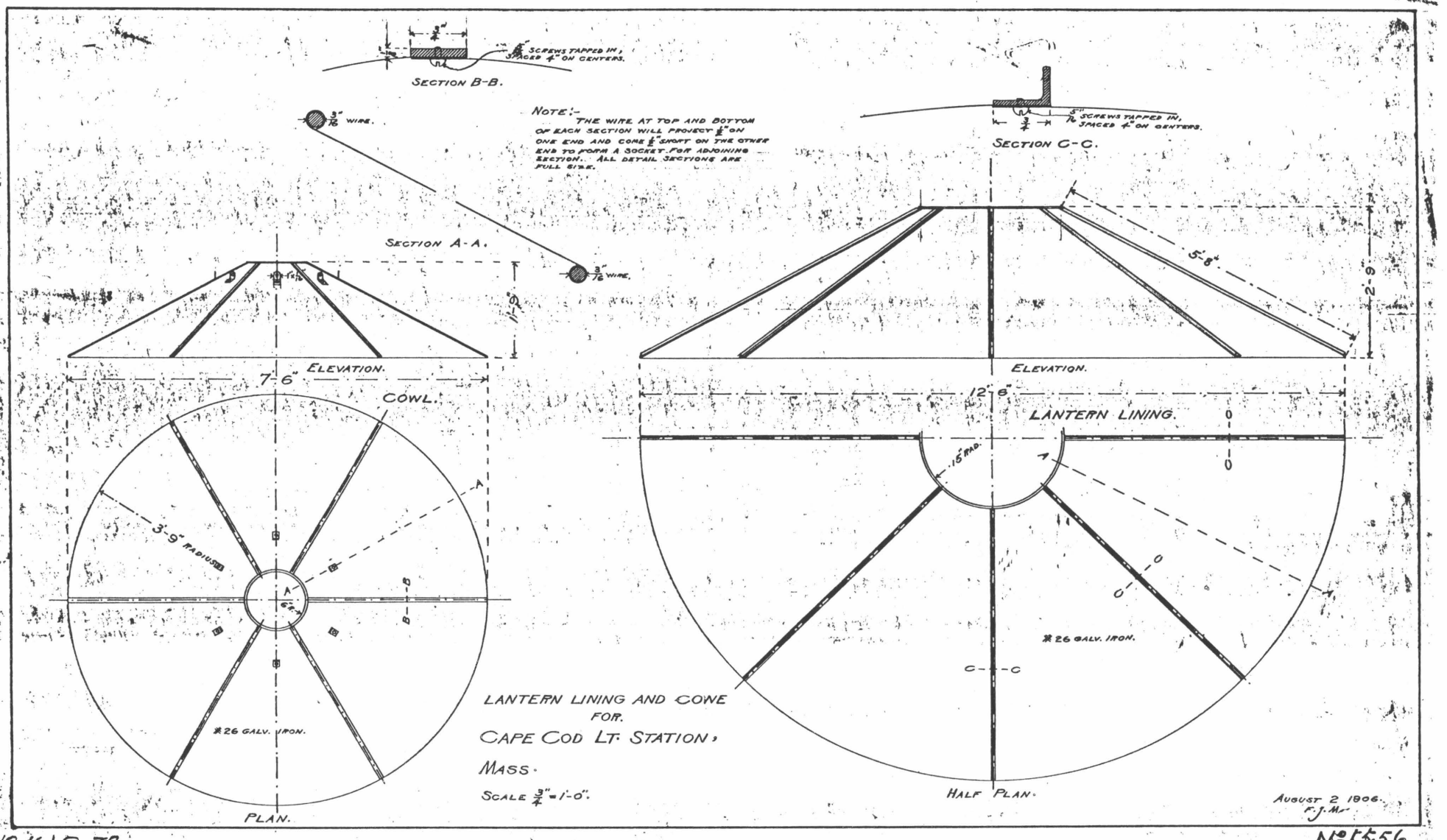
DRAWN BY C.E. STUMPKE, JR. MAY 20, 1903.

DRAWING No. 1696-12. No 2218.

APPENDIX Q.

LANTERN LINING AND COWL FOR CAPE COD LIGHT STATION, 1906

(Archives, USCG Civil Engineering Unit Providence)



(No 16) S. 38.

No 5556

APPENDIX R.

DESCRIPTIONS OF CAPE COD LIGHT STATION 1908, 1910, 1922, 1927 AND 1933

(Archives, USCG Civil Engineering Unit Providence)

Form 60

Second DISTRICT.

Department of Commerce and Labor

LIGHT-HOUSE ESTABLISHMENT

DESCRIPTION OF LIGHT-HOUSE TOWER,

BUILDINGS, AND PREMISES

AT

Cape Cod Light-Station,

Mass.

April 25, 1908

NOTE.

This Form is designed mainly to guide in preparing accurate descriptions of new light-stations, but will be used also in describing those that have been long established, when required. Screw-pile structures and lights on keepers' dwellings should be fully described without reference to this Form.

DEPARTMENT OF COMMERCE AND LABOR,
LIGHT-HOUSE BOARD, *February, 1906.*

NAME AND POSITION OF THE LIGHT-HOUSE AND LIGHT-STATION.

Cape Cod, on the highlands, on the northeasterly side of Cape Cod, seacoast of Massachusetts

1. By whom described, Lt Col Edw Burr, U.S.A. Engr 2d Lt District.
2. Date of description, April 25, 1908
3. Distinguishing character of light or lights, Flashing white every 5 secons

4. Latitude of tower, 42° 02' 23" } Authority, Coast Chart # 110
5. Longitude of tower, 70° 03' 40" } U.S. C & G.S.

PREMISES—A DETAILED DESCRIPTION OF, EMBRACING—

6. Site of station—Public land, purchase, Military or Naval reservation, lease:
   Purchase
7. Date of reservation,
8. Date of deed, August 5, 1796.
9. Date of permission to occupy,
10. Date of lease,
11. Area of the entire site, (In deed) 10 acres.
12. Area inclosed, 6 acres.
13. Character of surface soil, Sandy
14. Distance of tower from nearest high-water mark, 600 ft
15. Inclosures to premises, Three fences

16. Wharf or landing on premises, None

17. Road to landing or wharf, character of, and distance from tower, None

18. Means by which the light-station may be reached, Road

PREMISES—A DETAILED DESCRIPTION OF—CONTINUED.

tance to the nearest public road, railroad station, or steamboat landing, and to which:

tion is on public road 7 miles to RR station at North Truro, Mass.

tance to the nearest post-office, 1½ mile to North Truro, Mass

tance to the nearest village or town, to

ilities for reaching the light-station by public conveyance, None

ilities for reaching the light-station by private conveyance from the nearest village, town, railroad station r steamboat landing, and the distance: By horse & carriage from North Truro, Mass

er or other means used for supporting the lantern and apparatus, Tower

nber of separate lights, 1

en first built or established, 1798

en last thoroughly rebuilt, repaired, or renovated, 1857

dition at this date, Good

pe of tower in plan, Circular

m of tower, cylindrical, conical, or pyramidal, Conical

ght of tower from base to ventilator ball of lantern, 61 feet

ght of focal plane of lantern above mean high water (on sea and gulf coasts) or mean lake level on northern kes and rivers: 183

kground of the light-house, upon which it is projected, as seen from the sea or lake:

Sky

r of tower, White

or of tower, how produced: Whitewash

er—connected with keeper's dwelling, and how, or detached: Connected to dwelling by covered way

ect—seacoast, lake coast, bay, harbor, channel, or range; for general or local navigating purposes:

Seacoast

erials of which the tower is built: Brick

eral description, embracing—

Thickness of walls at base, 4'2"

Thickness of walls at parapet, 30"

Diameter of tower (inscribed, if polygonal) at base, 11' (Inside)

PREMISES—A DETAILED DESCRIPTION OF—CONTINUED.

General description, embracing—Continued.

43. Diameter of tower (inscribed, if polygonal) at parapet, 11' (inside)
44. Kind of stairway and steps, Cast iron
45. Number of landings of stairway, 3
46. Size of glass for glazing tower windows, 8 x 10
47. Number of windows in tower, and size of sash, 3 - Lower 2'3½" x 2'2 Upper same
48. Number of doors, 1 in tower and 1 in parapet
49. Kind of foundation and depth below the surface, Brick - 6 feet
50. Character of soil at and surrounding the light-house, Sandy
51. Soil susceptible of being protected by grass, shrubbery, or trees: Grass
52. Miscellaneous remarks upon tower and site:

LANTERN AND LANTERN FIXTURES.

53. Order or class of lantern, First
54. Polygonal or cylindrical, Polygonal
55. Diameter, inscribed, to glass, 12 ft
56. Number of sides in plan, 16
57. Vertical or helical bars, Vertical
58. Height glazed, 9'6"
59. Number of plates in height, 3
60. Number of plates in each side, 3
61. Thickness of plates, ¼"
62. Size of different plates, 47⅝ x 28 - 39⅜ x 28 25 3/8 x 28
63. Number of storm panes of glass, None
64. Unglazed side of lantern in plates and degrees of arc, None ; between what bearings (magnetic and *from seaward*),
65. Materials of which the lantern is constructed, Cast iron

LANTERN AND LANTERN FIXTURES—CONTINUED.

66. Roof, Cast iron

67. Ventilator ball, Cast iron

68. Lightning-conductor spindle, Rough iron - copper tip

69. Lightning conductor, of what material; how attached to spindle; how led, and how far below the surface of dry earth, or otherwise, as the case may be: Copper to lantern, led down side of tower, 4 feet into ground.

70. Balustrade and outside gallery, Stone gallery deck 24" wide, with iron railing consisting of two rails and 14 round posts and 1/2" square balusters

71. Lantern doors, and how fitted: No door in lantern. Balcony reached from watchroom which has double doors.

72. Floor of lantern—of what materials: Cast iron

73. Watchroom door leading into the lantern, and how fitted: No door - Lantern entered by iron spiral stairs

74. Parapet, inside diameter (inscribed, if polygonal), 10' 4"

VENTILATORS.

75. In parapet, wall, or lower part of lantern: In lower part of lantern

76. Lantern ladders for cleaning plate glass, outside: None

77. Curtain-hooks inside of lantern—how fitted: Spring roller curtains

WATCHROOM.

78. How fitted: Revolving cook stove

WATCHROOM—CONTINUED.

79. Bell wires, or speaking tubes, or telephones for calling relief keepers—kind:
Speaking tube

80. Where led: To 3 dwellings

ILLUMINATING APPARATUS, ETC.

81. Name of maker, Barbier & Benard, Year made, 1901

82. Marks and number on apparatus, Phares & Balises Paris

83. Order of apparatus, 1st Inside diameter (inscribed circle) of central drum, 6'

84. Characteristic of light shown by apparatus, White flash every 5 seconds

85. If movable; time of revolution, 20 seconds

86. Intervals between flashes, 5 seconds

87. Duration of flash, 1/2 "

88. If fixed, or fixed varied by flashes; state arc of each fixed part in degrees:

89. Number of panels in the lens apparatus, 4

90. Number of flash panels, 4 ; arc of each, in degrees,

91. Number of elements in each panel of central drum of the lens, 9

92. Number of prisms in each panel *above* the central drum of the lens, 18

93. Number of prisms in each panel *below* the central drum of the lens, 8

94. How are the flashes produced—By the whole apparatus revolving Yes . ; by revolving belt only if by panels of vertical elements revolving outside of fixed lens, state the number of such panels:

Describe how:

95. If by vertical elements, (*a*) state the number in each panel, ; (*b*) and the of elements of fixed lens covered by the panel:

ILLUMINATING APPARATUS, ETC.—CONTINUED.

96. Pedestal, Iron pedestal with mercury float

97. Service table, None

98. Tube leading through the center of the upper metal ring of the lens into the ventilator ball, to carry off the gases of combustion and to assist in producing a proper draft in the lantern—of what material, diameter, and how fitted and connected with damper tube when in place:
Regular 1st order connecting tube.

99. If revolving, revolving machinery: Rotary carriage, with mercury float operated by clockwork

100. Revolving on chariot, mercury float, or balls: Mercury

101. If a chariot, describe it and state the number and size of each pattern of wheels in it:

102. If on balls, describe the construction of the ball-raceways, whether flat surface, or semi-circular or V grooves:

103. State number of balls: ; diameter of balls,

104. Revolving cord or chain—how led: Cord, drops directly from drum

105. Length of drop tube, No tube open tower with guard for weight. 44' drop

106. Length of time revolving machinery will run after one winding: 2½ hours

107. How is the machinery protected: Iron frame with glass

ILLUMINATING APPARATUS, ETC.—CONTINUED.

108. How regulated; describe: Governor

IF COLORED LIGHT—

109. How is the color produced? Describe:

110. Red sectors—between what bearings (from seaward); magnetic, if on sea or gulf coasts; true on northern and rivers:

111. State where colored glass is attached, if to illuminating apparatus or to the lantern:

112. If colored glass is inside of illuminating apparatus, describe its form:

LAMPS AND BURNERS.

113. Description of lamp in use and number of wicks to burner: First order plunger 5 wicks

114. Number of spare lamps at the station, One

115. Number of spare lamp burners at the station, 3

CLOSETS IN TOWER.

116. How fitted and used: None

OILHOUSE OR ROOM.

117. Describe where placed and how fitted: Brick oil house painted white 150 N. Easterly of tower. No inside fittings

CLOSETS AND STOREROOMS.

118. Where placed, how fitted and used: Boat in service rooms, fitted with shelves used for storage of supplies for the light.

119. Damp or dry, suited or unsuited to the purposes for which they were designed:

dry & suited.

FOG SIGNAL.

120. Kind and character of apparatus: 1st class Daboll Trumpet with oil engine & compressor.

121. How much time is required to start the signal? Ten minutes.

122. Where, or by whom made: Made in U.S. Lt Machine Shop Boston, Mass.

Year made,

123. Characteristic distinction of:

Blast	Silent interval	Blast	Silent interval
8 sec.	30 sec.	8 sec.	30 sec.

124. What parts of the fog-signal machinery are in duplicate? Duplicate engine and timing device, and reeds.

125. If a bell, state (*a*) weight, lbs.; (*b*) metal, ; (*c*) diameter, ; (*d*) height, ;

(*e*) if struck by clockwork, state time it will run with one winding,

126. If a steam signal, (*a*) describe boiler:

(*b*) Kind:

(*c*) Flue-tube or water-tube,

(*d*) Dimensions: length, diameter,

(*e*) Number and length of tubes,

(*f*) Diameter of tubes,

(*g*) Furnace: Kind, ; length, ; width, ; height,

(*h*) Total heating surface in square feet,

(*i*) Grate surface in square feet,

(*j*) Number of grate bars,

FOG SIGNAL.—Continued.

(*k*) Kind of grate bars,

(*l*) Kind of coal or other fuel generally used,

(*m*) Kind of safety valve,

(*n*) Maximum pressure the boiler is capable of,

(*o*) Usual working pressure,

(*p*) Diameter of smokestack,

(*q*) Height of smokestack from grate,

(*r*) Height or length of steam drum, ; diameter,

(*s*) Kind of covering or jacket,

(*t*) Present condition of boiler,

(*u*) When built,

(*v*) Where built,

(*w*) By whom built,

(*x*) Is there a heater? ; what kind, ; what size,

How much does its use reduce the time of starting the fog signal?

127. If a steam engine is used, kind: Number of revolutions per minute,

(*a*) Diameter of cylinder,

(*b*) Stroke of piston,

(*c*) Size of steam pipe,

(*d*) When built,

(*e*) Where built,

(*f*) By whom built,

128. Whistle, trumpet, or siren, pressure at which blown,

129. Diameter of whistle, ; height, ; distance between orifice and edge of whistle,

single tone, ; chime,

130. Disk or cylindrical siren, ; diameter of revolving part,

when made, ; by whom made,

number, width and length of ports, ; revolutions per minute,

type of governor, ; condition of revolving part,

131. Daboll trumpet, . Reed, Steel ; length, 20" ; breadth, 5" ; thickness at base, 1/2"

thickness at tip, 3/8"

132. Trumpet: Length, 15' ; diameters, 5" x 18" ; material, Copper

133. Timing device: Gears & cams

FOG SIGNAL—CONTINUED.

134. Height of whistle or trumpet above mean high water, 111.2 feet

135. Direction, by compass, in which trumpet points, NE.

136. If signal is blown by compressed air, describe compressing machinery:

Kind of engine, Worthington Duplex ; by whom made, Worthington Machine Co.

when made, 1899 ; nominal size, 7"x12" horsepower, 40 ;

kind of compressor, 7x7 horizontal, Duplex; name of maker, American Air Compressor Works.

State if compressor is on same bed and geared with engine, or separate and belt-driven: Gear driven

137. Location, with reference to the light-house, to a particular danger or channel, or to the special object for establishing it: To warn vessels of their approach to the coast

138. Distance and direction from the light-house, 150 feet NE.

139. Water supply for it, Rain water

140. How it is reached from the light-house: Path

141. Description of fog-signal building or buildings: Brick fog-signal house 18'x22' in plan with hip roof. located about 150 ft. northeasterly from tower.

DWELLINGS FOR KEEPERS.

142. Location, with reference to the light-house tower: Connected by covered way to tower

143. Coloring: White

144. Materials of which built, Wood

145. Number of rooms in each dwelling, Keepers 6 - Asst Keepers 5 each

146. Number of keepers and assistants to each dwelling, One keeper in single dwelling; two assistant keepers - double dwelling

147. Outhouses, 3 fuel houses & barn

148. Coloring: White

149. Paths or walks on the premises, Plank Walks connect dwellings & from front door of [illegible]

DWELLINGS FOR KEEPERS—CONTINUED.

150. Area of premises inclosed, and how: 6 acres with wire fence

151. Area of garden,

152. Area in timber or shrubbery,

153. Area susceptible of profitable cultivation,

154. Area cultivated or prepared for cultivation,

None

155. Character of adjacent surrounding country—Soil, sandy, clay, marsh, swamp, wood, fast ground, or sl sands: Sandy

WATER FOR FOG SIGNAL, DRINKING, AND DOMESTIC USES GENERALLY.

156. How procured, Rain water from roofs of buildings

157. Quality, Good

158. Quantity ample or not for the station at all seasons of the year, No

159. Liable or not to be injured by the inroads of storm tides and seas, No

160. If rain water in tanks or cisterns, what precautions have been taken to insure its purity?

Cleaning cistern.

161. Capacity of tanks or cisterns, and where placed: 1500 gal. in cellar

162. Tanks or cisterns—of what material made: Brick

WATER FOR FOG SIGNAL, DRINKING, AND DOMESTIC USES GENERALLY—CONTINUED.

163. Is there a distilling apparatus at the station?

Name of maker:

Capacity, ; when installed, ; condition, ;

efficiency,

164. If from a well, describe and give depth:

165. Diameter,

166. Lined or not,

167. Water obtained by pump or bucket, Pump

168. Distance from keeper's dwelling, In dwelling

HEALTHFULNESS OF THE LIGHT-STATION AND VICINITY.

169. General opinion in regard to the healthfulness or unhealthfulness of the light-station and vicinity:

Healthful

170. Diseases—what are most prevalent at the station and in the vicinity? None

171. Do they prevail at particular seasons of the year, or not? No

172. Are there any local causes, such as swamps, marshes, etc., in the immediate vicinity of the light-house which are likely to be the cause of these diseases? No

HEALTHFULNESS OF THE LIGHT-STATION AND VICINITY—CONTINUED.

173. Would draining or other artificial means employed on the light-house premises be likely to improve the sa condition of the light-station?

No

LANDING, WHARF, BOATHOUSE, AND ROAD TO THE LIGHT-HOUSE.

174. Describe: None

The station is situated on the public road.

175. Distance and direction from light-house:

176. Hoisting engine, what kind?

Number of revolutions per minute, ; diameter of cylinder, ; stroke,

Kind of boiler:

Second DISTRICT

Department of Commerce and Labor

LIGHT-HOUSE ESTABLISHMENT

DESCRIPTION OF

BUILDINGS, PREMISES, EQUIPMENT

AT

Cape Cod

LIGHT-STATION,

Mass.

March 21 1910

11—2091

NOTE.

This Form is designed mainly to guide in preparing accurate descriptions of new light-stations, but will be used also in describing those that have been long established, when required, and especially when changes have been made at a station which affect the replies to the questions herein. Screw-pile structures and lights on keepers' dwellings should be fully described, as nearly as practicable, with reference to this Form.

DEPARTMENT OF COMMERCE AND LABOR,
LIGHT-HOUSE BOARD, *February, 1909.*

11—2921

NAME AND POSITION OF STATION.

Cape Cod, on the highlands, on the northeasterly side of Cape Cod, ea
of Massachusetts

1. By whom described, Lt. Col. Edw. Burr, Corps of Engineers, U.S.A., Engineer Second L.H.
2. Date of description, March 21, 1910
3. Distinguishing character of light or lights, Flashing white every five seconds

4. Latitude of light, 42° 02' 23" | Authority, U.S. Coast and Geodetic
5. Longitude of light, 70° 03' 40" | Chart No 110

PREMISES—A DETAILED DESCRIPTION OF, EMBRACING—

6. Site of station—Public land, purchase, Military or Naval reservation, lease: Purchase
7. Date of reservation,
8. Date of deed, August 5, 1796.
9. Date of permission to occupy,
10. Date of lease,
11. Area of the entire site,
12. Area inclosed,
13. Character of surface soil,
14. Distance of tower from nearest high-water mark,
15. Inclosures to premises,
16. Wharf or landing on premises,
17. Road to landing or wharf, character of, and distance from tower,
18. Means by which the light-station may be reached,

11—2921

PREMISES—A DETAILED DESCRIPTION OF—CONTINUED.

Distance to the nearest public road, railroad station, or steamboat landing, and to which:

[illegible]

Distance to nearest post office, [illegible]

Distance to nearest village or town, [illegible]

Facilities for reaching the light-station by public conveyance, [illegible]

Facilities for reaching light-station by private conveyance from nearest village, town, railroad station, or steamboat landing, and the distance: [illegible]

Tower or other means used for supporting the lantern and apparatus, [illegible]

Number of separate lights, [illegible]

When first built or established, [illegible]

When last thoroughly rebuilt, repaired, or renovated, [illegible]

Condition at this date,

Shape of tower in plan, Circular

Form of tower—Cylindrical, conical, or pyramidal, Conical

Height of tower from base to ventilator ball of lantern, 66-2"

Height of focal plane of lantern above mean high water (on sea and gulf coasts) or mean lake level on northern lakes and rivers: [illegible]

Background of the light-house, upon which it is projected, as seen from the sea or lake:

Sky

Color of tower, [illegible]

Color of tower, how produced: [illegible]

Tower—Connected with keeper's dwelling, and how, or detached: [illegible]

Object—Seacoast, lake coast, bay, harbor, channel, or range; for general or local navigating purposes:

Primary [illegible]

Materials of which the tower is built: [illegible]

General description, embracing—

Thickness of walls at base, [illegible]

Thickness of walls at parapet, 2'-2"

PREMISES—A DETAILED DESCRIPTION OF—CONTINUED.

General description, embracing—Continued.

42. Diameter of tower (inscribed, if polygonal) at base, [illegible]
43. Diameter of tower (inscribed, if polygonal) at parapet, [illegible]
44. Kind of stairway and steps, [illegible]
45. Number of landings of stairway, [illegible]
46. Size of glass for glazing tower windows, [illegible]
47. Number of windows in tower, and size of sash, [illegible]
48. Number of doors,
49. Kind of foundation and depth below the surface, [illegible]
50. Character of soil at and surrounding the light-house, [illegible]
51. Soil susceptible of being protected by grass, shrubbery, or trees: [illegible]
52. Miscellaneous remarks upon tower and site: [illegible]

LANTERN AND LANTERN FIXTURES.

53. Order or class of lantern, [illegible]
54. Polygonal or cylindrical, [illegible]
55. Diameter, inscribed (*a*) to glass, 12'-1" ; (*b*) in the clear, [illegible]
56. Number of sides in plan, 16
57. Vertical or helical bars, [illegible]
58. Height glazed, 9'-11½"
59. Number of plates in height, 3
60. Number of plates in each side, 3
61. Thickness of plates, [illegible]
62. Size of different plates, [illegible] 28" x 47½"
63. Number of storm panes of glass,
64. Unglazed side of lantern in plates and degrees of arc, [illegible] ; between what bearings (*true* and *from seaward*),
65. Materials of which the lantern is constructed,

LANTERN AND LANTERN FIXTURES—CONTINUED.

Roof, [illegible]

Ventilator ball, [illegible]

Lightning-conductor spindle, [illegible]

Lightning conductor, of what material; how attached to spindle; how led, and how far below the surface of dry earth, or otherwise, as the case may be: [illegible] attached to lan- [illegible]

Balustrade and outside gallery, [illegible]

Lantern doors, and how fitted: [illegible]

Floor of lantern—Of what materials: [illegible]

Watchroom door leading into lantern, and how fitted: [illegible]

Parapet, inside diameter (inscribed, if polygonal), Circular 10' in diameter

VENTILATORS.

In parapet, wall, or lower part of lantern: Four pair of Ventilators

Lantern ladders for cleaning plate glass, outside: [illegible]

Curtain hooks inside of lantern—How fitted: [illegible]

WATCHROOM.

How fitted: [illegible]

WATCHROOM—CONTINUED.

79. Bell wires, or speaking tubes, or telephones for calling relief keepers—Kind: [illegible]

80. Where led: [illegible]

ILLUMINATING APPARATUS, ETC.

81. Name of maker, [illegible] Year made, 1901

82. Marks and number on apparatus, [illegible]

83. Order of apparatus, 1st Inside diameter (inscribed circle, tangent to *glass*) of central drum, 6'-

84. Characteristic of light shown *by apparatus*, [illegible]

85. If movable; time of revolution, —

86. Intervals between flashes, 1/20 [illegible]

87. Duration of flash, 1/2

88. If fixed, or fixed varied by flashes, state arc of each fixed part in degrees: [illegible]

89. Number of panels in the lens apparatus, 28

90. Number of flash panels, 4 ; arc of each, in degrees, 10°

91. Number of elements in each panel of central drum of lens, 8

92. Number of prisms in each panel *above* central drum of lens, 18

93. Number of prisms in each panel *below* central drum of lens, 8

94. How are the flashes produced—By the whole apparatus revolving [illegible]; by revolving belt only if by panels of vertical elements revolving outside of fixed lens, state the number of such panels:

Describe how:

95. If by vertical elements, (*a*) state the number in each panel, ; (*b*) and the number of elements of fixed lens covered by the panel:

ILLUMINATING APPARATUS, ETC.—CONTINUED.

light is occulting, state (*a*) the characteristic,

(*b*) Between what time limits may characteristic be varied without structural changes in mechanism,

(*c*) Are eclipses produced by sleeve, revolving screens, or valve (if gas light),

(*d*) Size of sleeve and amplitude of movement,

(*e*) Axis of rotation of screens, horizontal or vertical, ; (*f*) relation of axis to vertical axis of illuminating apparatus,

Screens: (*g*) Do they revolve as parts, or independently, of illuminating apparatus,

(*h*) If about vertical axis, how many in circumference, ; (*i*) time required for complete revolution, ; (*j*) form, ; (*k*) how mounted (see Questions 101–109), ; (*l*) if actuated by standard clockwork, state order, ; (*m*) date made,

If occultation is effected by valve (*n*) state name of maker, ;

(*o*) pattern, ; (*p*) does it operate reliably,

Pedestal,

Service table,

Tube leading through center of upper metal ring of lens into ventilator ball, to carry off gases of combustion and to assist in producing proper draft in lantern—Of what material, diameter, and how fitted and connected with damper tube when in place:

If revolving, revolving machinery:

Revolving on chariot, mercury float, or balls:

If a chariot, describe it and state the number and size of each pattern of wheels in it:

ILLUMINATING APPARATUS, ETC.—CONTINUED.

103. If on balls, describe the construction of the ball-raceways, whether flat surface, or semicircular or V grooves:

104. State number of balls: ; diameter of balls,

105. Revolving cord or chain—How led:

106. Length of drop tube,

107. Length of time revolving machinery will run after one winding:

108. How is the machinery protected?

109. How regulated? Describe:

IF COLORED LIGHT—

110. How is the color produced? Describe:

111. Red sectors—Between what bearings, true (from seaward):

112. State where colored glass is attached, if to illuminating apparatus or to lantern:

113. If colored glass is inside of illuminating apparatus describe its form:

ILLUMINATING APPARATUS, ETC.—CONTINUED.

96. If light is occulting, state (*a*) the characteristic.

(*b*) Between what time limits may characteristic be varied without structural changes in mechanism,

(*c*) Are eclipses produced by sleeve, revolving screens, or valve (if gas light),

(*d*) Size of sleeve and amplitude of movement,

(*e*) Axis of rotation of screens, horizontal or vertical, ; (*f*) relation of axis to vertical axis of illuminating apparatus,

Screens: (*g*) Do they revolve as parts, or independently, of illuminating apparatus,

(*h*) If about vertical axis, how many in circumference, ; (*i*) time required for complete revolution, ; (*j*) form, ; (*k*) how mounted (see Questions 101–109), ; (*l*) if actuated by standard clockwork, state order, ; (*m*) date made,

If occultation is effected by valve (*n*) state name of maker, ;

(*o*) pattern, ; (*p*) does it operate reliably,

97. Pedestal,

98. Service table,

99. Tube leading through center of upper metal ring of lens into ventilator ball, to carry off gases of combustion and to assist in producing proper draft in lantern—Of what material, diameter, and how fitted and connected with damper tube when in place:

100. If revolving, revolving machinery:

101. Revolving on chariot, mercury float, or balls:

102. If a chariot, describe it and state the number and size of each pattern of wheels in it:

ILLUMINATING APPARATUS, ETC.—CONTINUED.

103. If on balls, describe the construction of the ball-raceways, whether flat surface, or semicircular or V

104. State number of balls: ; diameter of balls,

105. Revolving cord or chain—How led:

106. Length of drop tube,

107. Length of time revolving machinery will run after one winding:

108. How is the machinery protected?

109. How regulated? Describe:

IF COLORED LIGHT—

110. How is the color produced? Describe:

111. Red sectors—Between what bearings, true (from seaward):

112. State where colored glass is attached, if to illuminating apparatus or to lantern:

113. If colored glass is inside of illuminating apparatus describe its form:

LAMPS, BURNERS, ETC.

1st Order

114. (*a*) Description of lamp in use and number of wicks, ~~or mantels~~, to burner, Straight ;
(*b*) diameter of outside wick, 1 3/8" ; (*c*) ~~diameter of mantel~~, ; (*d*) if more than one mantel, also ~~diameter of circumscribing circle~~,
if gas light, (*e*) state kind, ; (*f*) number of burners, if more than one in group, ; (*g*) kind of burner, ; (*h*) candlepower per burner, ;
(*i*) total candlepower of group, ; (*j*) consumption of gas per burner per hour, cubic feet; (*k*) total consumption per hour, cubic feet; (*l*) how is gas obtained? ; if generated at station,
(*m*) describe generator, ; (*n*) state name of maker, ; (*o*) date of pattern, ;
(*p*) maximum capacity per hour, cubic feet. If compressed gas is used, (*q*) describe container, ; (*r*) capacity, cubic feet of free gas; (*s*) to what pressure charged, lbs.; (*t*) how is supply renewed? ;
(*u*) if by substitution of full for empty container, at what intervals,

115. Number of spare lamps at station,

116. Number of spare lamp burners at station, None

CLOSETS IN TOWER.

117. How fitted and used, None

OILHOUSE OR ROOM.

118. Describe (*a*) where placed and how fitted, ;
(*b*) inside dimensions, ; (*c*) materials of which built, ;
(*d*) capacity in 5-gallon cans, 700

CLOSETS AND STOREROOMS.

119. Where placed, how fitted and used,

120. Damp or dry, suited or unsuited to the purposes for which they were designed,

FOG SIGNAL.

121. Kind and character of apparatus:

122. How much time is required to start the signal? ; how long may the signal sound characteristic with the quantity of air stored under pressure?

123. Where, or by whom, made:
Year made,

124. Characteristic distinction of:

Blast	Silent interval	Blast	Silent interval
5 sec.	30 sec.	8 sec.	30 sec.

125. What parts of the fog-signal machinery are in duplicate? Air pump

126. If a bell, state (*a*) weight, lbs.; (*b*) metal, ; (*c*) diameter, ; (*d*) height, ;
(*e*) if struck by clockwork, state time it will run with one winding:

127. If a steam signal, (*a*) describe boiler:
(*b*) Kind,
(*c*) Flue-tube or water-tube,
(*d*) Dimensions: length, diameter,
(*e*) Number and length of tubes,
(*f*) Diameter of tubes,
(*g*) Furnace: Kind, ; length, ; width, ; height,
(*h*) Total heating surface in square feet,
(*i*) Grate surface in square feet,
(*j*) Number of grate bars,
(*k*) Kind of grate bars,
(*l*) Kind of coal or other fuel generally used,
(*m*) Kind of safety valve,
(*n*) Maximum pressure the boiler is capable of,
(*o*) Usual working pressure,
(*p*) Diameter of smokestack,
(*q*) Height of smokestack from grate,
(*r*) Height or length of steam drum, ; diameter,

FOG SIGNAL—CONTINUED.

(*s*) Kind of covering or jacket,

(*t*) Present condition of boiler,

(*u*) When built,

(*v*) Where built,

(*w*) By whom built,

(*x*) Is there a heater? ; what kind? ; what size?

How much does its use reduce the time of starting the fog signal?

128. If a steam engine is used, kind: Number of revolutions per minute,

(*a*) Diameter of cylinder,

(*b*) Stroke of piston,

(*c*) Size of steam pipe,

(*d*) When built,

(*e*) Where built,

(*f*) By whom built,

129. Whistle, trumpet, or siren, pressure at which blown, 4½ to 5½ lbs.

130. Diameter of whistle, ; height, ; distance between orifice and edge of whistle, ; single tone, ; chime,

131. Disk or cylindrical siren, ; diameter of revolving part, ; when made, ; by whom made, ; number, width, and length of ports, ; revolutions per minute, ; type of governor, ; condition of revolving part,

132. Daboll trumpet, 4 in. Reed, Yes ; length, 20" ; breadth, 5" ; thickness at base, 13/16" ; thickness at tip, 3/8"

133. Trumpet: Length, 15' ; diameters, 5" & 14" ; material, Copper

134. Timing device, Automatic Clock

135. Height of whistle or trumpet above mean high water, 150 feet

136. Direction, *true*, in which trumpet points, 47°

137. If signal is blown by compressed air, describe compressing machinery:

Kind of engine, ; by whom made, ; when made, 1899 ; nominal size, 17 ; horsepower, ; kind of compressor, ; name of maker, Air Compressor Works

State if compressor is on same bed and geared with engine, or separate and belt-driven:

Air Compressor

FOG SIGNAL—CONTINUED.

138. Location, with reference to light-house, to a particular danger or channel, or to the special object for which established: Trellis Foundation tower, Shoving point [illegible]

139. Distance and direction, *true*, from light-house, [illegible] 150 feet

140. Water supply for it, [illegible]

141. How is it reached from the light-house? [illegible] on the bank.

142. Description of fog-signal building or buildings: [illegible]

DWELLINGS FOR KEEPERS.

143. Location, with reference to light-house tower: ~~Dwelling~~ Single dwelling north, double dwelling East, of Tower

144. Coloring: [illegible]

145. Materials of which built, [illegible]

146. Number of rooms in each dwelling, 6 [illegible] 5 each in the two quarters

147. Number of keepers and assistants to each dwelling, Keepers and one hand live in double house

148. Outhouses, ~~Three~~ Four

149. Coloring: [illegible]

150. Paths or walks on the premises, Earth paths

151. Area of premises inclosed, and how: About 6 acres by picket fence

152. Area of garden, [illegible]

153. Area in timber or shrubbery,

154. Area susceptible of profitable cultivation, [illegible] hay — 5 acres

DWELLINGS FOR KEEPERS—CONTINUED.

55. Area cultivated or prepared for cultivation, [illegible]

56. Character of adjacent surrounding country—Soil, sandy, clay, marsh, swamp, wood, fast ground, or shifting sands: [illegible]

WATER FOR FOG SIGNAL, DRINKING, AND DOMESTIC USES GENERALLY.

57. How procured, [illegible]

58. Quality, [illegible]

59. Quantity ample or not for the station at all seasons of the year, [illegible]

60. Liable or not to be injured by the inroads of storm tides and seas, [illegible]

61. If rain water in tanks or cisterns, what precautions have been taken to insure its purity?
[illegible]

62. Capacity of tanks or cisterns, and where placed: [illegible] 1200 Gallons

63. Tanks or cisterns—Of what material made: [illegible]

64. Is there a distilling apparatus at the station? [illegible]

Name of maker:

Capacity, ; when installed, ; condition, ;

efficiency,

65. If from a well, describe and give depth: [illegible]

66. Diameter, [illegible]

67. Lined or not, [illegible]

68. Water obtained by pump or bucket, [illegible]

69. Distance from keeper's dwelling, [illegible]

HEALTHFULNESS OF THE LIGHT-STATION AND VICINITY.

170. General opinion in regard to the healthfulness or unhealthfulness of the light-station and vicinity:

171. Diseases—What are most prevalent at the station and in the vicinity?

172. Do they prevail at particular seasons of the year, or not?

173. Are there any local causes, such as swamps, marshes, etc., in the immediate vicinity of the light-house which are likely to be the cause of these diseases? [illegible]

174. Would draining or other artificial means employed on the light-house premises be likely to improve the sanitary condition of the light-station? [illegible]

LANDING, WHARF, BOATHOUSE, AND ROAD TO THE LIGHT-HOUSE.

175. Describe:

176. Distance and direction from light-house:

177. Hoisting engine, what kind?

Number of revolutions per minute, ; diameter of cylinder, ; stroke,

Kind of boiler:

MISCELLANEOUS REMARKS UPON THE GENERAL CHARACTER AND CONDITION OF THE PREMISES, TOWERS, BUILDINGS, AND ILLUMINATING APPARATUS AT THIS DATE.

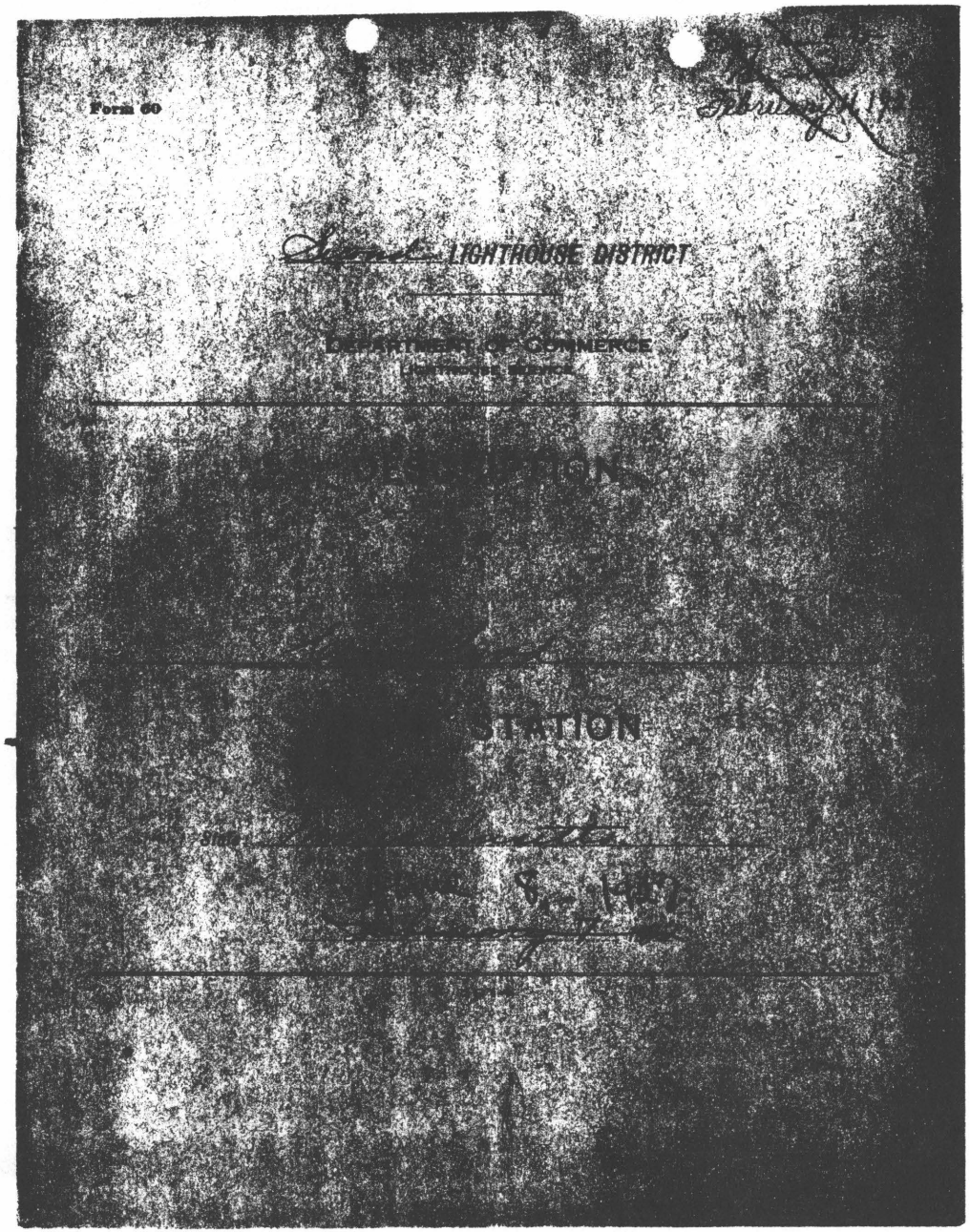
All in Good Condition
A brick oil house used by the Navy Dep. is located 313 ft. ± northeasterly from the tower

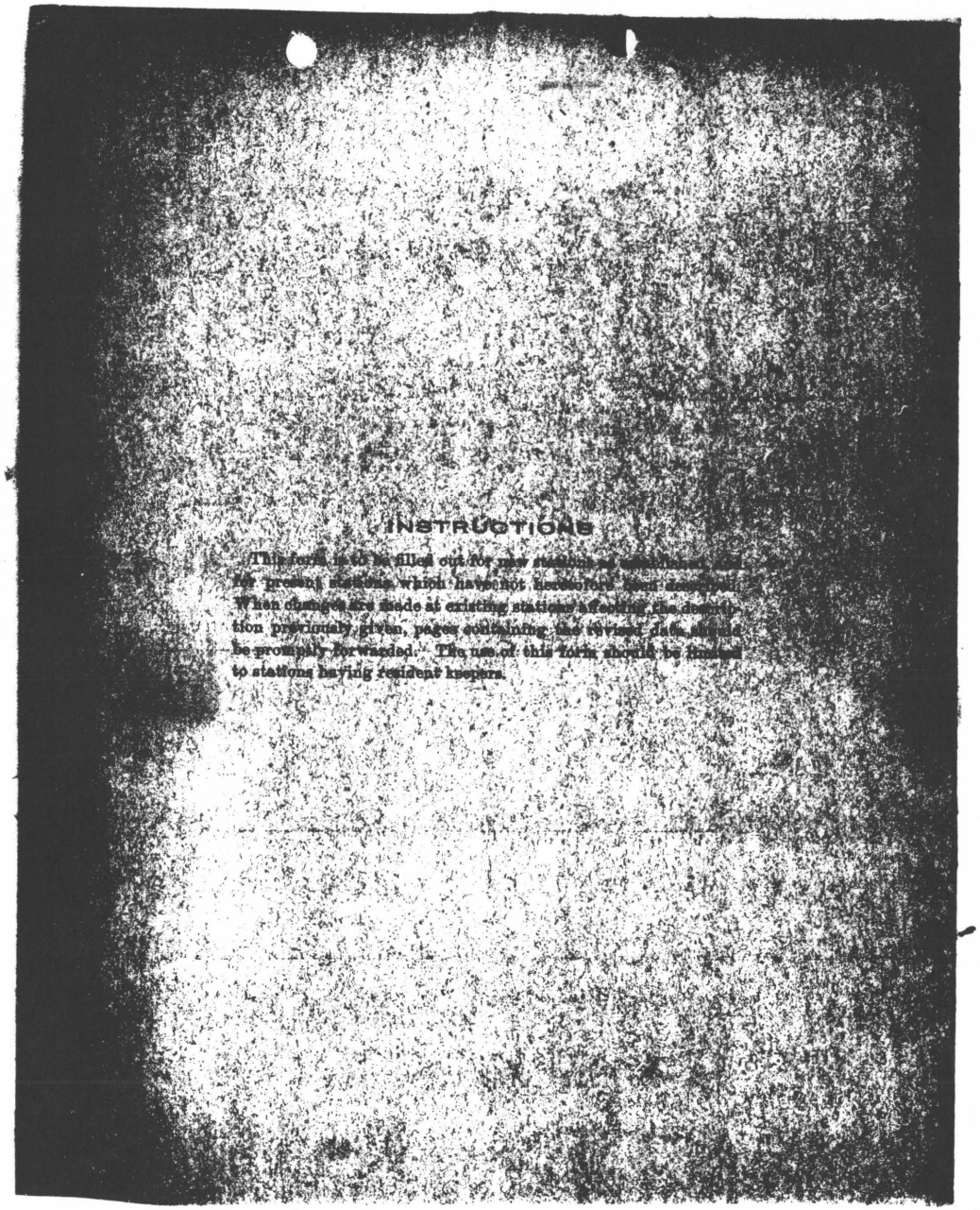
The premises, tower, buildings & illuminating apparatus are in good condition
A brick oil-house, used by the Navy Department, is located 313 feet northeasterly from tower.
~~Coke Coal~~ There is a signal-display station on the reservation

Respectfully,

Edw. Burr.

Lt. Col. Corps of Engineers, U. S. A.,
Engineer, Second Light-House District.


Form 60
LIGHTHOUSE DISTRICT
DEPARTMENT OF COMMERCE
STATION



INSTRUCTIONS

This form is to be filled out for new stations and when changes for present stations which have not heretofore been described. When changes are made at existing stations affecting the description previously given, pages containing the revised data should be promptly forwarded. The use of this form should be limited to stations having resident keepers.

DESCRIPTION OF LIGHT STATION.

1. By whom described [illegible] Engineer, June 8, 1927. date [illegible]

STATION.

2. Name of station, Cape Cod

3. Characteristic of light, Flashing white every 5 seconds.

4. Geographical position of light: Latitude, 42° 02' 23"; longitude, 70° 03' 40".

5. Location, On Highlands northeast side of Cape Cod, Mass.

PREMISES.

6. Origin of title to site of station (public land, purchase, lease, military or naval reservation), Purchase.

7. Date of reservation, deed, lease, or permission to occupy, [illegible]

8. Area of the entire site, 10 [illegible] (b) area inclosed, Wall; (c) type of fence, Stone concrete.

9. Distance of tower from nearest high-water mark, About 950 feet.

10. Wharf or landing on premises, [illegible]

11. Means by which the light station may be reached and distance to nearest post office or town, with name, [illegible] road [illegible] Post Office [illegible] Truro [illegible]

12. Tower or other means used for supporting the lantern and apparatus, Tower.

13. Number of separate lights, One.

14. When first built or established, 1798

PREMISES—Continued.

15. When last thoroughly rebuilt, repaired, or renovated, 1859

16. Height of focal plane of lantern above mean high water (on sea and gulf coasts) or mean lake level on northern lakes and rivers, 183 feet

17. Background of the lighthouse, upon which it is projected, as seen from seaward, sky

18. Color of tower, and how produced, White – whitewash

19. Tower—Connected with keeper's dwelling, and how; or detached, Connected by covered way

20. Purpose of aid—Seacoast, lake coast, bay, harbor, channel, or range; for general or local navigation, ~~Coast and general navigation~~ Primary Seacoast

21. Materials of which the tower is built, Brick and concrete

22. Kind of stairway and steps, Iron

23. Size of glass for glazing tower windows, 8"x10" and 9"x10½"

24. Number of windows in tower, and size of sash, Three. 2-8½"x20½" 1-9"x20½"

25. Number and size of doors, One – 3'-0"x7'-0"

26. General remarks upon tower and site, Tower stands on concrete foundation. Lightning rod

LANTERN AND LANTERN FIXTURES.

27. Order or class of lantern, 1st Order

28. If polygonal, state number of sides; if cylindrical, state diameter, Octagonal 16 sides

29. Vertical or helical bars, Vertical; thickness of bars, 15" ; height glazed, 9'-11½" 4'-5½"

30. Number of plates in height, Three ; in each side, Three

31. Thickness and size of plates, 1" Top Row 28"x 47 5/8 – 16 2/3 lbs
Middle Row 28"x 37 – 16 "
Bottom " 28"x 25 – 16 "

32. Unglazed side of lantern in plates and degrees of arc, Circle ;
between what bearings (true and from seaward), —

33. Materials of which the lantern is constructed, Iron

34. Roof, Iron

LANTERN AND LANTERN FIXTURES—Continued.

35. Ventilator ball, Iron

36. Lightning-conductor spindle, Copper. Platinum tip. Is grounded

37. Balustrade and outside gallery, Yes.

38. Lantern doors, and how fitted, Iron. Hinged with Latch.

39. Floor of lantern—Of what materials, Iron

40. Watch-room door leading into lantern, and how fitted, Iron gas and handle

VENTILATORS.

41. In parapet, wall, or lower part of lantern, Lower part of lantern

42. Lantern ladders for cleaning plate glass, outside, Iron

43. Curtain hooks inside of lantern—How fitted, Shade rollers

WATCH ROOM.

44. How fitted, ~~Painted and furnished~~ Painted sides sheathed

45. Bell wires, speaking tubes, or telephones for calling relief keepers—Kind, ~~Telephone~~ Speaking tubes

46. Where led, To two dwellings

ILLUMINATING APPARATUS, ETC.

47. Kind of apparatus, Flashing white ; intensity in English candles, 150 000

48. Name of maker, Barbier & Fenestre and Turenne ; year made, 1891

49. Marks and number on apparatus, Paris

50. Order of apparatus, First ; inside diameter (inscribed circle, tangent to glass) of central drum, 6'-0½"

51. **If the apparatus is a parabolic mirror,** state (*a*) diameter of opening, None ; (*b*) depth of mirror, — ; (*c*) its focal length, — ; (*d*) material of which it is made, —

52. **If revolving,** time of revolution, 20 seconds
(*a*) duration of flash, 0.2 sec.; (*b*) duration of eclipse, 4.8 sec.

53. **If fixed,** or fixed varied by flashes, state arc of each fixed part in degrees, — ;
(*a*) duration of fixed light, — sec.; (*b*) eclipse, — sec.; (*c*) flash, — sec.

ILLUMINATING APPARATUS, ETC.—Continued.

54. Number of panels in the lens apparatus, 25

55. Number of flash panels, 1; arc of each, in degrees, 200

56. Number of elements in each panel of central drum of lens, 5

57. Number of prisms in each panel *above* central drum of lens, 18; are they fixed or flash? Fixed

58. Number of prisms in each panel *below* central drum of lens, 5; are they fixed or flash? Fixed

59. How are the flashes produced—By the whole apparatus revolving Yes; by revolving belt only —; if by panels or vertical elements revolving outside of fixed lens, state the number of such panels, —

60. **If by vertical elements,** state (*a*) the number in each panel, —; and (*b*) the number of elements of fixed lens covered by the panel, —

61. **If light is occulting,** state (*a*) the characteristic, —

(*b*) Between what time limits may characteristic be varied without structural changes in mechanism? —

(*c*) Are eclipses produced by sleeve, revolving screens, or valve (if gaslight)? —

(*d*) Size of sleeve and amplitude of movement, —

(*e*) Axis of rotation of screens, horizontal or vertical, —; (*f*) relation of axis to vertical axis of illuminating apparatus, —

(*g*) Do the screens revolve as parts, or independently, of illuminating apparatus? —

(*h*) If about vertical axis, how many in circumference, —; (*i*) time required for complete revolution, —; (*j*) form, —;

(*k*) how mounted (see Questions 62–65), —;

(*l*) if actuated by clockwork, state order and maker, —;

(*m*) date made, —

If occultation is effected by valve, state (*n*) name of maker, —;

(*o*) pattern, —;

(*p*) does it operate reliably? —

62. **If revolving,** does the apparatus revolve on chariot wheels, mercury float, or balls? Mercury float

63. **If a chariot,** describe it and state the number and size of each pattern of wheels in it, —

ILLUMINATING APPARATUS, ETC.—Continued.

64. **If on mercury float,** give (*a*) inside diameter of trough, 5'-14"; (*b*) inside depth of trough, 10"; (*c*) outside diameter of float, 5'-7"; (*d*) depth of float, 11½"; (*e*) weight of mercury required, in pounds, about 600; (*f*) how often mercury is renewed? Has not been renewed since 1901

65. **If on balls,** (*a*) describe the construction of the ball-raceways, whether they are flat surface or semicircular or V grooves, —; (*b*) is a cage used to separate balls? —; (*c*) state number of balls, —; (*d*) diameter of balls, —

66. Clock cord or chain, kind, —; size, —; length, —; how led, —; diam. and length of clock drum, —

67. Length and inside dimensions of drop tube or weight box, No tube, weight passes through clock weight, about 200 pounds.

68. Length of time clock will run after one winding, 2½ hours

69. Does clock drive apparatus while being rewound? Yes

70. How is the machinery protected? Glass case

71. How regulated? By Fontaine Lay Fall governor

72. Describe the pedestal, Cast iron

73. Lens protector—Is there one? No; kind, —

74. Draft tube leading into ventilator ball—Of what material, diameter, and how fitted and connected with damper tube when in place, Iron Pipe 4" diam. Tube in place by collar.

75. **If colored light,** (*a*) how is the color produced? —

(*b*) state where colored glass is attached, if to illuminating apparatus or to lantern, —

76. If colored glass is inside of illuminating apparatus, describe its form, —

77. Red sectors—Between what bearings, true (from seaward), —

LAMPS, BURNERS, ETC.

78. Description of lamp: (*a*) give order, 55 inch DCV.; (*b*) kind of illuminant, Kero
(*c*) intensity in English candles, 550.00

If oil, or oil vapor:

(*a*) number of wicks, or mantels, to burner, One mantle ✓;
(*b*) diameter of outside wick, —; (*c*) diameter of mantel, 2 1/8" ✓;
(*d*) if more than one mantel, also diameter of circumscribing circle, One only ✓

If gaslight:

(*e*) state kind, None; (*f*) number of burners, if more than one burner in group, —; (*g*) kind of burner, —;
(*h*) candlepower per burner, —; (*i*) total candlepower of group, —;
(*j*) size of burner in cubic feet of gas per hour, —;
(*k*) consumption of gas per hour, — cubic feet; (*l*) how is gas obtained?

If gas is generated at station:

(*m*) describe generator, None;
(*n*) state name of maker, —;
(*o*) date of pattern, —; (*p*) maximum capacity per hour, — cubic feet.

If compressed gas is used:

(*q*) describe container and give number in service, None; spare —;
(*r*) capacity, — cubic feet of free gas; (*s*) to what pressure charged, — lbs.; (*t*) how is supply renewed? —;
(*u*) if by substitution of full for empty container, at what intervals? —

79. Number of spare lamps at station, Two

80. Number of spare lamp burners at station, —

CLOSETS IN TOWER.

81. How fitted and used, None

OIL HOUSE OR ROOM.

82. Describe (*a*) where placed and how fitted, About 150 feet N.E'ly from tower no fittings
(*b*) inside dimensions, 11'-10" X 13'-8"; (*c*) materials of which built, Brick;
(*d*) capacity in 5-gallon cans, 700

CLOSETS AND STOREROOMS.

83. Where placed, how fitted and used, None

84. Damp or dry, suited or unsuited to the purpose for which they were designed, —

FOG SIGNAL.

85. Kind and character of apparatus, 1st Class Daboll trumpet

86. How much time is required to sound the signal? 5 to 8 minutes; how long may the signal sound its characteristic with the quantity of air stored under pressure? One minute

87. Characteristic:

If ~~whistle~~, trumpet, ~~or siren~~:				~~If bell~~:			
Blast 8 sec.	Silent 30 sec.	Blast 8 sec.	Silent 30 sec.	... strokes	Silent ... sec.	... strokes	Silent ... sec.

88. What parts of the fog-signal machinery are in duplicate? All parts

89. Location, with reference to lighthouse, to a particular danger or channel, or to the special object for which established, To warn mariners from easterly side of Cape Cod

90. Distance and direction, true, from lighthouse, 140 feet 77°

91. Water supply for it, Cistern water

92. How is it reached from the lighthouse? Path

FOG SIGNAL—Continued.

93. **Description** of fog-signal building or buildings, Brick house with hip roof

94. **If a bell,** state (*a*) weight, None lbs.; (*b*) metal, —; (*c*) diameter, —; (*d*) height, —; (*e*) if struck by clockwork, state time it will run with one winding, —; (*f*) maker and date, —; (*g*) weights for operating, — lbs.

95. **If a steam signal,** describe boiler: (*a*) type, None; (*b*) length, —; (*c*) diameter, —; (*d*) horsepower, —; (*e*) maker and date, —; (*f*) Is there a heater? No; what kind? —; what size? —; how much does its use reduce the time of starting the fog signal?

96. **If a steam engine is used:** (*a*) kind, None; (*b*) number of revolutions per minute, —; (*c*) diameter of cylinder, —; (*d*) stroke of piston, —; (*e*) horsepower, —; (*f*) maker and date, —

97. **If internal combustion engines are used:** (*a*) kind of engine, Hornsby Akroyd; (*b*) maker, Dr. Co. Vern Refg & Mch. Co.; (*c*) date, 1899; (*d*) nominal size, 7"X8"; (*e*) horsepower, 4; (*f*) fuel used, Kerosene; (*g*) how started, Hot tube; (*h*) kind of compressor, Single stage; (*i*) maker and date, Clayton Air Compressor Works 1899

State if compressor is on same bed and geared with engine, or separate and belt-driven, or both pistons on same rod, Separate bed geared if geared or belt-driven, state ratio, 1 to 2

Describe compressor machinery, (*a*) diameter of cylinder, 7"; (*b*) stroke of piston, 7"; (*c*) number of revolutions per minute, 150; (*d*) character and size of air-inlet valves, disc 4"; (*e*) kind of unloader, None; safety valve on tank (*f*) diameter of delivery pipe, 1½"

FOG SIGNAL—Continued.

98. (*a*) Number air receivers, Three; (*b*) diameter, Two 3-6 one 3-3"; (*c*) height, Two 8-0; one 7-6 (*d*) capacity cubic feet, each, Two 8[illegible] one 65; (*e*) pressure in each, 5½; (*f*) make of reducing valve, if used, None; (*g*) remarks, These engines are ideal for [illegible] purposes

99. **If whistle, trumpet, or siren,** pressure at which blown, 5½ lbs.

100. Diameter of whistle, None; height, —; distance between orifice and edge of whistle, —; single tone, —; chime, —

101. **If disk or cylindrical siren,** None; diameter of revolving part, —; when made, —; by whom made, —; number, width, and length of ports, —; revolutions per minute, —; type of governor, —; condition of revolving part, —

102. **If Daboll trumpet:** Class, 1st; reed: length, 20"; breadth, 5"; thickness at base, 1 3/16"; thickness at tip, 7/8"

103. **If trumpet:** Length, 15'-0"; diameters, 5" & 14; material, Copper

104. Timing device, Automatic clocks

105. Height of whistle or trumpet above mean high water, 150 feet

106. Direction, *true*, in which trumpet points, 47°

107. Pressure and recording gauge, Yes

DWELLINGS FOR KEEPERS.

108. Location with reference to lighthouse tower, Keepers dwelling South, East of tower

109. Coloring, White, Lead & trimmings

110. Materials of which built, Wood

111. Number of dwellings, Two; number of rooms in each, Five single & Bath. Two double

112. Describe heating plant, Two Vertical Boilers with Coil each side

113. Number of keepers and assistants in each dwelling, Keeper in single, two Asst's in double

114. Which keepers are furnished quarters? All

115. Which keepers are not furnished quarters? None

116. Outhouses, Two fuel houses & pump house; coloring, White lead trimmings

117. Paths or walks on the premises, Flagstone walks to fuel houses

118. Area susceptible of profitable cultivation, Whole; area cultivated or prepared for cultivation, None

DWELLINGS FOR KEEPERS—Continued.

119. Character of adjacent surrounding country—Soil, sandy, clay, marsh, swamp, wood, fast ground, or shifting sands, Sandy

120. Furnish following data for stoves, kitchen sink, sink pump, and lamps in quarters:

Articles.	Keeper.	1st Assistant Keeper.	2d Assistant Keeper.	3d Assistant Keeper.
Stove, maker,	Magee Grand	Magee Grand	Magee Grand	
Stove, size,	7-18	7-18	7-18	
Sink, maker,	Not Known	Not Known	Not Known	
Sink, size,	22"x48"	22"x48"	22"x48"	
Pump, maker,	Douglas	Douglas	Douglas	
Pump, size,	No 2	No 2	No 2	
LAMPS. (Give name, number, and make of all lamps in such set of quarters.)	1 brass hand and 1 brass table lamp from Geo. Dept	do	do	

WATER FOR FOG SIGNAL, DRINKING, ETC.

121. How procured, From deep drivne well and from roofs

122. Quality, Good

123. Quantity ample or not for the station at all seasons of the year, Ample

124. Liable or not to be injured by the inroads of storm tides and seas, No

125. If rain water in tanks or cisterns, what precautions have been taken to insure its purity? Inspect cleaning

126. Capacity of tanks or cisterns, and where placed, Cisterns in each dwelling 1200 Gals

127. Tanks or cisterns—Of what material made, Bricks cement plastered.

WATER FOR FOG SIGNAL, DRINKING, ETC.—Continued.

128. Is there a distilling apparatus at the station? None

Name of maker and date, —;

capacity, —; when installed, —; condition, —;

efficiency, —

129. If from a well, describe and give depth, Drivne well 153 feet deep

130. Diameter, 4"; lined or not, Iron pipe

131. Water obtained by pump or bucket, Pump and pump; what power is used? Gasoline engine

132. Distance from keeper's dwelling, 16 feet

HEALTHFULNESS OF STATION.

133. General opinion in regard to the healthfulness of the light station and vicinity, Healthful

134. Diseases—What are most prevalent at the station and in the vicinity? None

135. Do they prevail at particular seasons of the year, or not? —

136. Are there any local causes, such as swamps, marshes, etc., in the immediate vicinity of the lighthouse which are likely to be the cause of these diseases? No

137. Would draining or other artificial means employed on the lighthouse premises be likely to improve the sanitary condition of the light station? No

BOATS.

138. Furnish following data for each boat at station: None

Number.	Type.	Length.	Width.	When Built.	Date Received at Station.	Is Boat Fitted with Sails?	Suited to Work Performed.

BOATS—Continued.

139. **If power boat,** kind of engine, None; horsepower, —;
maker of engine, shop number, and date, —
(*a*) type, size, number, and maker's name of spare coil, —
(*b*) type, size, number, and maker's name of magneto, —
(*c*) type and number of batteries, —
(*d*) propeller wheel, diameter, —; pitch, —

140. Where are boats kept at station? None

LANDING, WHARF, BOATHOUSE, AND ROAD TO THE LIGHTHOUSE.

141. Description, None

142. Distance and direction of landing from lighthouse, No suitable Beach Landing

143. Hoisting engine, what kind? None;
diameter of cylinder, —; number of revolutions per minute, —;
stroke, —; kind of boiler, —;
maker and date, —

144. General Remarks: The Tower dwellings Fog Signal & building and apparatus are in good condition. There is a wireless station operated by Navy Dept located on north end of reservation.

Form 60.

SECOND LIGHTHOUSE DISTRICT

DEPARTMENT OF COMMERCE
LIGHTHOUSE SERVICE

DESCRIPTION

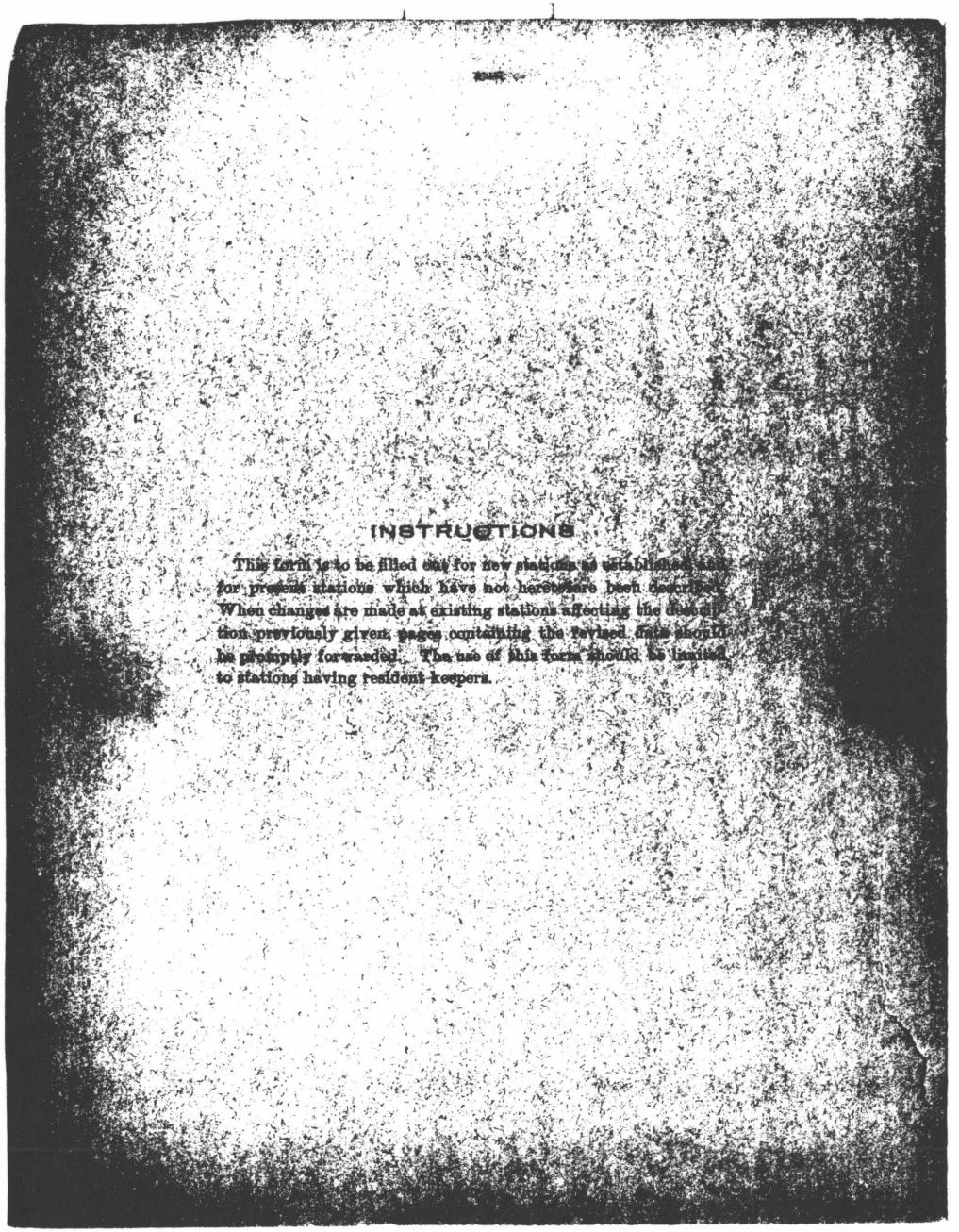
OF

LIGHT STATION

State MASSACHUSETTS

1796
1798

580'



INSTRUCTIONS.

This form is to be filled out for new stations as established, and for present stations which have not heretofore been described. When changes are made at existing stations affecting the description previously given, pages containing the revised data should be promptly forwarded. The use of this form should be limited to stations having resident keepers.

DESCRIPTION OF LIGHT STATION.

1. By whom described _____, date _____

STATION.

2. Name of station, Cape Cod

3. Characteristic of light, Flashing white every 5 seconds.

4. Geographical position of light: Latitude, 42° 02' 23"; longitude, 70° 03' 40".

5. Location, On highlands northeast side of Cape Cod Mass.

PREMISES.

6. Origin of title to site of station (public land, purchase, lease, military or naval reservation), Purchase

7. Date of reservation, deed, lease, or permission to occupy, August 5, 1796

8. Area of the entire site, 10A. 47 ~~Poles~~ (b) area inclosed, whole.; (c) type of fence, Wire concrete posts.

9. Distance of tower from nearest high-water mark, About 580 feet.

10. Wharf or landing on premises, None

11. Means by which the light station may be reached and distance to nearest post office or town, with name, By public road: Post Office, North Truro, distant 1¼ miles.

12. Tower or other means used for supporting the lantern and apparatus, Tower

13. Number of separate lights, One

14. When first built or established, 1798

PREMISES—Continued.

15. When last thoroughly rebuilt, repaired, or renovated, 1857
16. Height of focal plane of lantern above mean high water (on sea and gulf coasts) or mean lake level on northern lakes and rivers, 183 feet
17. Background of the lighthouse, upon which it is projected, as seen from seaward, Sky
18. Color of tower, and how produced, White - whitewash
19. Tower—Connected with keeper's dwelling, and how; or detached, Connected by covered way
20. Purpose of aid—Seacoast, lake coast, bay, harbor, channel, or range; for general or local navigation, Primary seacoast
21. Materials of which the tower is built, Bricks and cement
22. Kind of stairway and steps, Iron
23. Size of glass for glazing tower windows, 8 x 10" and 9 x 10½"
24. Number of windows in tower, and size of sash, Three 2'-3½" x 22½"
25. Number and size of doors, One 3'-0" x 7'-0"
26. General remarks upon tower and site, Tower sets on concrete foundation - Land is sandy

LANTERN AND LANTERN FIXTURES.

27. Order or class of lantern, 1st order
28. If polygonal, state number of sides; if cylindrical, state diameter, Polygonal - 16 sides
29. Vertical or helical bars, Vertical; thickness of bars, 1⅛"; height glazed, 9'-5⅞"
30. Number of plates in height, Three; in each side, Three
31. Thickness and size of plates, ¼" - Top Row 28" x 47⅝" - 16 Lts. Middle " 28" x 39" - 16 " Bottom " 28" x 25" - 16 "
32. Unglazed side of lantern in plates and degrees of arc, none; between what bearings (true and from seaward), —
33. Materials of which the lantern is constructed, Iron
34. Roof, Iron

LANTERN AND LANTERN FIXTURES—Continued.

35. Ventilator ball, Iron
36. Lightning-conductor spindle, Copper, platinum tip and grounded
37. Balustrade and outside gallery, Yes
38. Lantern doors, and how fitted, Iron hinged with latch
39. Floor of lantern—Of what materials, Iron
40. Watch-room door leading into lantern, and how fitted, Hinges and handle

VENTILATORS.

41. In parapet, wall, or lower part of lantern, Lower part of lantern
42. Lantern ladders for cleaning plate glass, outside, Iron
43. Curtain hooks inside of lantern—How fitted, Spring rollers

WATCH ROOM.

44. How fitted, Pedestal and sides sheathed
45. Bell wires, speaking tubes, or telephones for calling relief keepers—Kind, None
46. Where led, —

ILLUMINATING APPARATUS, ETC.

47. Kind of apparatus, Flashing white; intensity in English candles, 4,000,000
48. Name of maker, Barbier, Benard & Turenne; year made, 1901
49. Marks and number on apparatus, Paris
50. Order of apparatus, First; inside diameter (inscribed circle, tangent to glass) of central drum, 6'-0½"
51. **If the apparatus is a parabolic mirror,** state (*a*) diameter of opening, none; (*b*) depth of mirror, —; (*c*) its focal length, —; (*d*) material of which it is made, —
52. **If revolving,** time of revolution, 20 seconds
    (*a*) duration of flash, 0.2 sec.; (*b*) duration of eclipse, 4.8 sec.
53. **If fixed,** or fixed varied by flashes, state arc of each fixed part in degrees, —;
    (*a*) duration of fixed light, — sec.; (*b*) eclipse, — sec.; (*c*) flash, — sec.

ILLUMINATING APPARATUS, ETC.—Continued.

54. Number of panels in the lens apparatus, 28

55. Number of flash panels, 4; arc of each, in degrees, 90°

56. Number of elements in each panel of central drum of lens, 8

57. Number of prisms in each panel *above* central drum of lens, 18; are they fixed or flash? Flashing

58. Number of prisms in each panel *below* central drum of lens, 8; are they fixed or flash? Flashing

59. How are the flashes produced—By the whole apparatus revolving Yes; by revolving belt only —; if by panels or vertical elements revolving outside of fixed lens, state the number of such panels, —

60. **If by vertical elements,** state (*a*) the number in each panel, —; and (*b*) the number of elements of fixed lens covered by the panel, —

61. **If light is occulting,** state (*a*) the characteristic, —

(*b*) Between what time limits may characteristic be varied without structural changes in mechanism? —

(*c*) Are eclipses produced by sleeve, revolving screens, or valve (if gaslight)? —

(*d*) Size of sleeve and amplitude of movement, —

(*e*) Axis of rotation of screens, horizontal or vertical, —; (*f*) relation of axis to vertical axis of illuminating apparatus, —

(*g*) Do the screens revolve as parts, or independently, of illuminating apparatus? —

(*h*) If about vertical axis, how many in circumference, —; (*i*) time required for complete revolution, —; (*j*) form, —;

(*k*) how mounted (see Questions 62–65), —;

(*l*) if actuated by clockwork, state order and maker, —;

(*m*) date made, —

If occultation is effected by valve, state (*n*) name of maker, —;

(*o*) pattern, —;

(*p*) does it operate reliably? —

62. **If revolving,** does the apparatus revolve on chariot wheels, mercury float, or balls? Mercury float

63. **If a chariot,** describe it and state the number and size of each pattern of wheels in it, —

—

ILLUMINATING APPARATUS, ETC.—Continued.

64. **If on mercury float,** give (*a*) inside diameter of trough, 5'-7 1/4"; (*b*) inside depth of trough, 10"; (*c*) outside diameter of float, 5'-7"; (*d*) depth of float, 11 1/2"; (*e*) weight of mercury required, in pounds, about 600; (*f*) how often mercury is renewed? Never has been renewed since 1901

65. **If on balls,** (*a*) describe the construction of the ball-raceways, whether they are flat surface or semicircular or V grooves, None; (*b*) is a cage used to separate balls? —; (*c*) state number of balls, —; (*d*) diameter of balls, —

66. Clock cord or chain, kind, —; size, —; length, —; how led, —; diam. and length of clock drum, —

67. Length and inside dimensions of drop tube or weight box, No tube, weight goes in stair well. clock weight, about 200 pounds.

68. Length of time clock will run after one winding, 2 1/4 hours

69. Does clock drive apparatus while being rewound? yes

70. How is the machinery protected? Glass case

71. How regulated? By friction fly ball governor. The above clock is now used as standby - use motor and speed reducer unit for driving lens.

72. Describe the pedestal, Cast iron

73. Lens protector—Is there one? no; kind, —

74. Draft tube leading into ventilator ball—Of what material, diameter, and how fitted and connected with damper tube when in place, yes - black iron 7 1/2" dia. held in space by cellar

75. **If colored light,** (*a*) how is the color produced? —

(*b*) state where colored glass is attached, if to illuminating apparatus or to lantern, —

76. If colored glass is inside of illuminating apparatus, describe its form, —

77. Red sectors—Between what bearings, true (from seaward), —

LAMPS, BURNERS, ETC.

78. Description of lamp: (*a*) give order, 1000 watt PS-52-clear C-7 filament, elec. incandescent; (*b*) kind of illuminant, Electric;
(*c*) intensity in English candles, 1670

If oil, or oil vapor:

(*a*) number of wicks, or mantels, to burner, —;
(*b*) diameter of outside wick, —; (*c*) diameter of mantel, —;
(*d*) if more than one mantel, also diameter of circumscribing circle, —

If gaslight:

(*e*) state kind, none; (*f*) number of burners, if more than one burner in group, —; (*g*) kind of burner, —;
(*h*) candlepower per burner, —; (*i*) total candlepower of group, —;
(*j*) size of burner in cubic feet of gas per hour, —;
(*k*) consumption of gas per hour, — cubic feet; (*l*) how is gas obtained? —

If gas is generated at station:

(*m*) describe generator, none;
(*n*) state name of maker, —;
(*o*) date of pattern, —; (*p*) maximum capacity per hour, — cubic feet.

If compressed gas is used:

(*q*) describe container and give number in service, none; spare —;
(*r*) capacity, — cubic feet of free gas; (*s*) to what pressure charged, — lbs.; (*t*) how is supply renewed? —;
(*u*) if by substitution of full for empty container, at what intervals? —

79. Number of spare lamps at station, Four
80. Number of spare lamp burners at station, —

CLOSETS IN TOWER.

81. How fitted and used, none

OIL HOUSE OR ROOM.

82. Describe (*a*) where placed and how fitted, About 150 ft. N.E.ly from tower (no fittings)
(*b*) inside dimensions, 11'-10" x 13'-8"; (*c*) materials of which built, Bricks;
(*d*) capacity in 5-gallon cans, 700 – 56 cell battery installed in oilhouse to supply current for station needs

CLOSETS AND STOREROOMS.

83. Where placed, how fitted and used, none

84. Damp or dry, suited or unsuited to the purpose for which they were designed, —

FOG SIGNAL.

85. Kind and character of apparatus, 1st class Daboll trumpet steam Type 335 Sub Signal Co. air oscillator main fog signal. Installed 1929

86. How much time is required to sound the signal? ~~5 to 8 minutes~~; how long may the signal sound its characteristic with the quantity of air stored under pressure? One minute

87. Characteristic:

If ~~whistle~~, trumpet, ~~or siren~~:				~~If bell~~:			
Blast ~~8~~ sec.	Silent 30 sec.	Blast ~~8~~ sec.	Silent ~~30~~ sec.	... strokes	Silent ... sec.	... strokes	Silent ... sec.

88. What parts of the fog-signal machinery are in duplicate? All parts

89. Location, with reference to lighthouse, to a particular danger or channel, or to the special object for which established, To warn mariners from easterly side of Cape Cod.

90. Distance and direction, true, from lighthouse, 140 feet 77°

91. Water supply for it, Cistern water

92. How is it reached from the lighthouse? Path

FOG SIGNAL—Continued.

93. Description of fog-signal building or buildings, Brick house with hip roof

94. **If a bell,** state (*a*) weight, None lbs.; (*b*) metal, —; (*c*) diameter, —; (*d*) height, —; (*e*) if struck by clockwork, state time it will run with one winding, —; (*f*) maker and date, —; (*g*) weights for operating, — lbs.

95. **If a steam signal,** describe boiler: (*a*) type, None; (*b*) length, —; (*c*) diameter, —; (*d*) horsepower, —; (*e*) maker and date, —

(*f*) Is there a heater? —; what kind? —; what size? —; how much does its use reduce the time of starting the fog signal? —

96. **If a steam engine is used:** (*a*) kind, None; (*b*) number of revolutions per minute, —; (*c*) diameter of cylinder, —; (*d*) stroke of piston, —; (*e*) horsepower, —; (*f*) maker and date, —

97. **If internal combustion engines are used:** (*a*) kind of engine, Hornsby-Akroyd; (*b*) maker, De La Vergne Refg. & Mch. Co. and Nowt Engine; (*c*) date, 1899; (*d*) nominal size, 7x8"; (*e*) horsepower, 4; (*f*) fuel used, Kerosene; (*g*) how started, Hot ball; (*h*) kind of compressor, Single stage; (*i*) maker and date, Clayton Air Compressor Works 1899

State if compressor is on same bed and geared with engine, or separate and belt-driven, or both pistons on same rod, Sep. bed geared; if geared or belt-driven, state ratio, 1 to 2

Describe compressor machinery, (*a*) diameter of cylinder, 7"; (*b*) stroke of piston, 7"; (*c*) number of revolutions per minute, —; (*d*) character and size of air-inlet valves disc 1½"; (*e*) kind of unloader, safety valve on tank; (*f*) diameter of delivery pipe, 1½"

FOG SIGNAL—Continued.

98. (*a*) Number air receivers, Two; (*b*) diameter, Two 3-6 one 3'-3"; (*c*) height, Two 8-0 one 7-6; (*d*) capacity in cubic feet, each, Two 8-0 one 6-5; (*e*) pressure in each, 5½; (*f*) make of reducing valve, if used, None; (*g*) remarks, These engines are ideal for fog signal purposes

99. **If whistle, trumpet, or siren,** pressure at which blown, 5½ lbs.

100. Diameter of whistle, None; height, —; distance between orifice and edge of whistle, —; single tone, —; chime, —

101. **If disk or cylindrical siren,** —; diameter of revolving part, —; when made, —; by whom made, —; number, width, and length of ports, —; revolutions per minute, —; type of governor, —; condition of revolving part, —

102. **If Daboll trumpet:** Class, 1st; reed: length, 20"; breadth, 5"; thickness at base, 1 5/16"; thickness at tip, 3/8"

103. **If trumpet:** Length, 15'-0"; diameters, 5" and 14; material, Copper

104. Timing device, Centomatic clocks

105. Height of whistle or trumpet above mean high water, 150 feet

106. Direction, *true*, in which trumpet points, 47°

107. Pressure and recording gauge, Yes

DWELLINGS FOR KEEPERS.

108. Location with reference to lighthouse tower, Keepers' dwelling North-Assts' East of tower

109. Coloring, White lead trimmings

110. Materials of which built, Wood

111. Number of dwellings, Two; number of rooms in each, Six single & Bath - Ten double with bath each side

112. Describe heating plant, Direct hot water

113. Number of keepers and assistants in each dwelling, Keeper in single, two Assts in double.

114. Which keepers are furnished quarters? All

115. Which keepers are not furnished quarters? None

116. Outhouses, Two fuel houses & pump house; coloring, White lead trim.

117. Paths or walks on the premises, Cement walks to fuel houses

118. Area susceptible of profitable cultivation, whole; area cultivated or prepared for cultivation None

DWELLINGS FOR KEEPERS—Continued.

119. Character of adjacent surrounding country—Soil, sandy, clay, marsh, swamp, wood, fast ground, or shifting sands, sandy

120. Furnish following data for stoves, kitchen sink, sink pump, and lamps in quarters:

Articles.	Keeper.	1st Assistant Keeper.	2d Assistant Keeper.	3d Assistant Keeper.
Stove, maker,	Magee-Grand	Magee-Grand	Magee-Grand	
Stove, size,	7-18	7-18	7-18	
Sink, maker,	Don't know	Not known	not known	
Sink, size,	22x48"	22x48"	22x48"	
Pump, maker,	Douglas	Douglas	Douglas	
Pump, size,	No. 2	No. 2	No. 2	
Lamps. (Give name, number, and make of all lamps in such set of quarters.)	1 brass hand and 1 brass table lamp from Gen. Depot.	do	do	

WATER FOR FOG SIGNAL, DRINKING, ETC.

121. How procured, From deep driven well and from roofs.

122. Quality, Good

123. Quantity ample or not for the station at all seasons of the year, Ample

124. Liable or not to be injured by the inroads of storm tides and seas, No

125. If rain water in tanks or cisterns, what precautions have been taken to insure its purity? Frequent cleaning

126. Capacity of tanks or cisterns, and where placed, Cisterns in each dwelling 1200 gals.

127. Tanks or cisterns—Of what material made, Bricks cement plastered.

WATER FOR FOG SIGNAL, DRINKING, ETC.—Continued.

128. Is there a distilling apparatus at the station? None

Name of maker and date, —;

capacity, —; when installed, —; condition, —;

efficiency, —

129. If from a well, describe and give depth, Driven well 153 feet deep.

130. Diameter, 4"; lined or not, Iron pipe

131. Water obtained by pump or bucket, Pump; what power is used? Kerosene engine and pump.

132. Distance from keeper's dwelling, 16 feet

HEALTHFULNESS OF STATION.

133. General opinion in regard to the healthfulness of the light station and vicinity, Healthful

134. Diseases—What are most prevalent at the station and in the vicinity? None

135. Do they prevail at particular seasons of the year, or not? —

136. Are there any local causes, such as swamps, marshes, etc., in the immediate vicinity of the lighthouse which are likely to be the cause of these diseases? No

137. Would draining or other artificial means employed on the lighthouse premises be likely to improve the sanitary condition of the light station? No

BOATS.

138. Furnish following data for each boat at station: None

Number.	Type.	Length.	Width.	When Built.	Date Received at Station.	Is Boat Fitted with Sails?	Suited to Work Performed.

BOATS—Continued.

139. **If power boat,** kind of engine, None; horsepower, —;

maker of engine, shop number, and date, —

(*a*) type, size, number, and maker's name of spare coil, —

(*b*) type, size, number, and maker's name of magneto, —

(*c*) type and number of batteries, —

(*d*) propeller wheel, diameter, —; pitch, —

140. Where are boats kept at station? —

LANDING, WHARF, BOATHOUSE, AND ROAD TO THE LIGHTHOUSE.

141. Description, None

142. Distance and direction of landing from lighthouse, No suitable beach landing.

143. Hoisting engine, what kind? None;

diameter of cylinder, —; number of revolutions per minute, —;

stroke, —; kind of boiler, —;

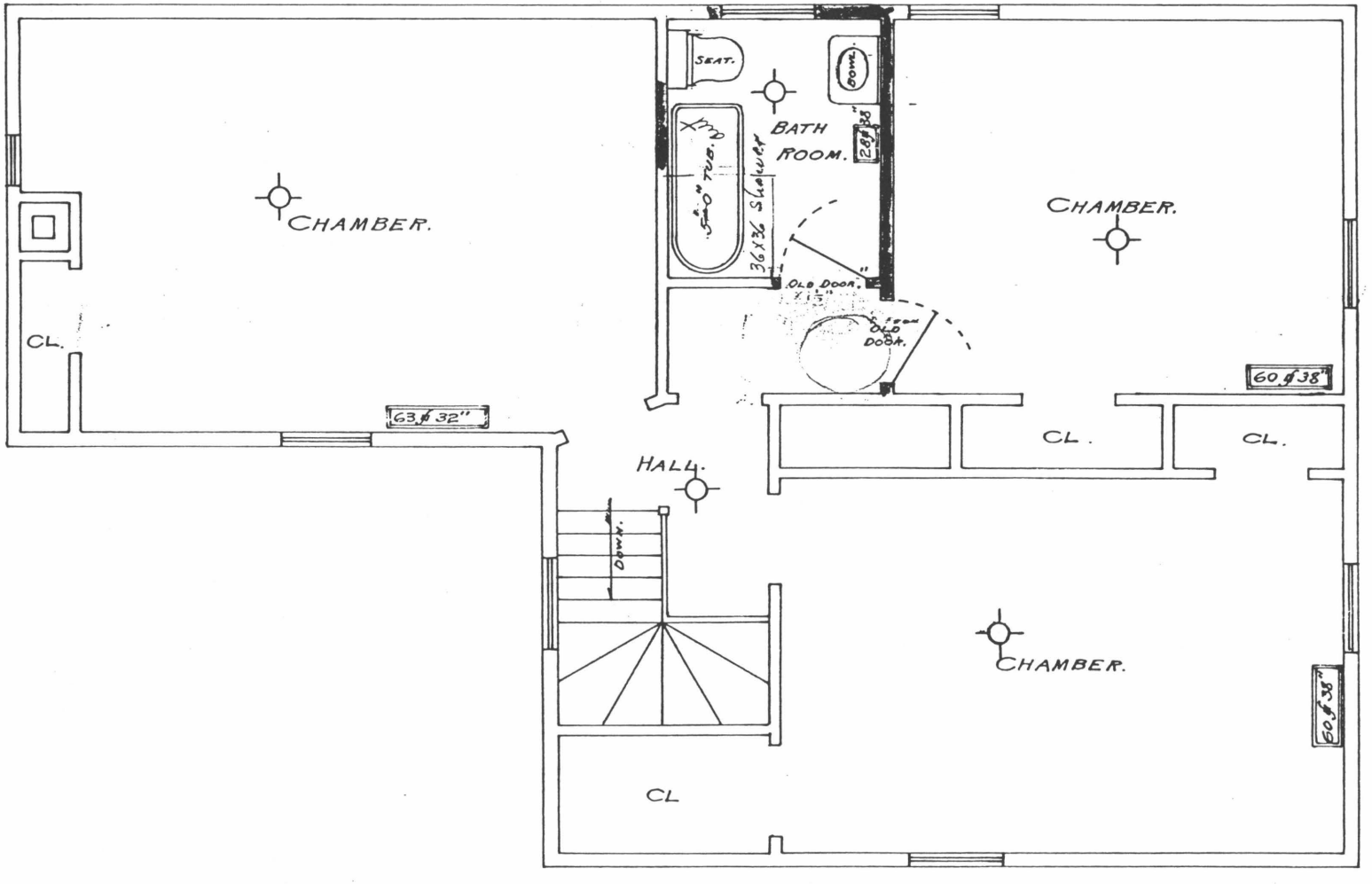
maker and date, —

144. General Remarks: The tower dwellings, fog signal building and apparatus in good condition. There is a wireless station and compass station operated by Navy Dept. located on northerly end of reservation. Light changed to electric Oct. 28, 1933.

APPENDIX S.

CAPE COD LIGHT STATION, KEEPER'S DWELLING SECOND FLOOR ALTERATION FOR ADDITION OF BATHROOM, 1909

(Archives, USCG Civil Engineering Unit Providence)



SECOND FLOOR PLAN.
SCALE 1/4" = 1'-0".

SEPT. '09.
F.J.M.

CAPE COD 4/5 1577 (8)

APPENDIX T.

CAPE COD LIGHT STATION, SHOWING LOCATION OF BUILDINGS, ETC., 1909

(Archives, USCG Civil Engineering Unit Providence)

CAPE COD LT. STATION, MASS.

SHOWING LOCATION OF BUILDINGS ETC.

No 1552



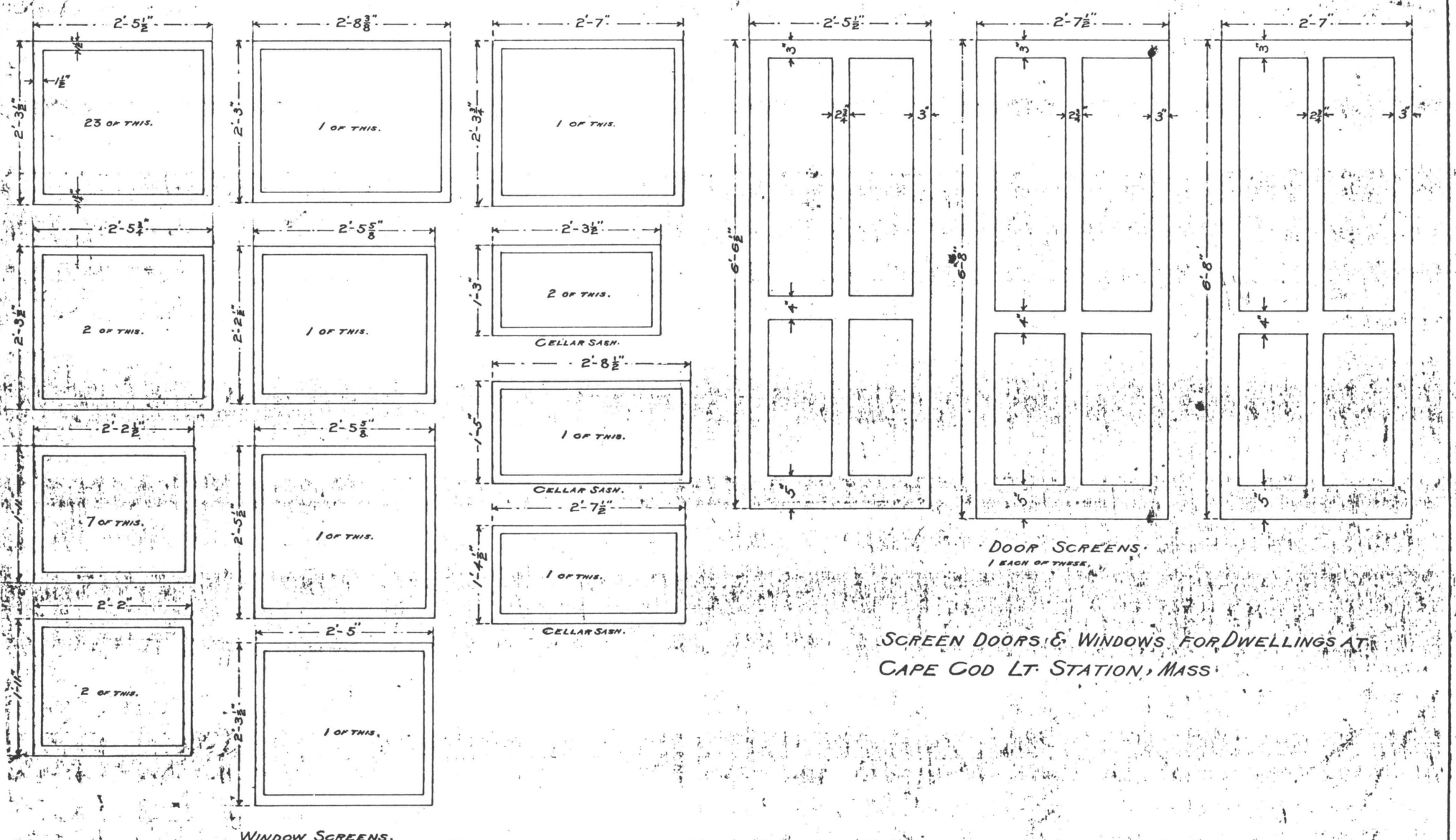
(No 8) S. 38.

No 1552 Nov'c

APPENDIX U.

SCREEN DOORS & WINDOWS FOR DWELLINGS AT CAPE COD LIGHT STATION, 1910

(Archives, USCG Civil Engineering Unit Providence)



SCREEN DOORS & WINDOWS FOR DWELLINGS AT CAPE COD LT. STATION, MASS.

FIG. 19

V23 S 38

No 6560

APPENDIX V.

CAPE COD LIGHT STATION
ELECTRIFICATION OF STATION, 1932

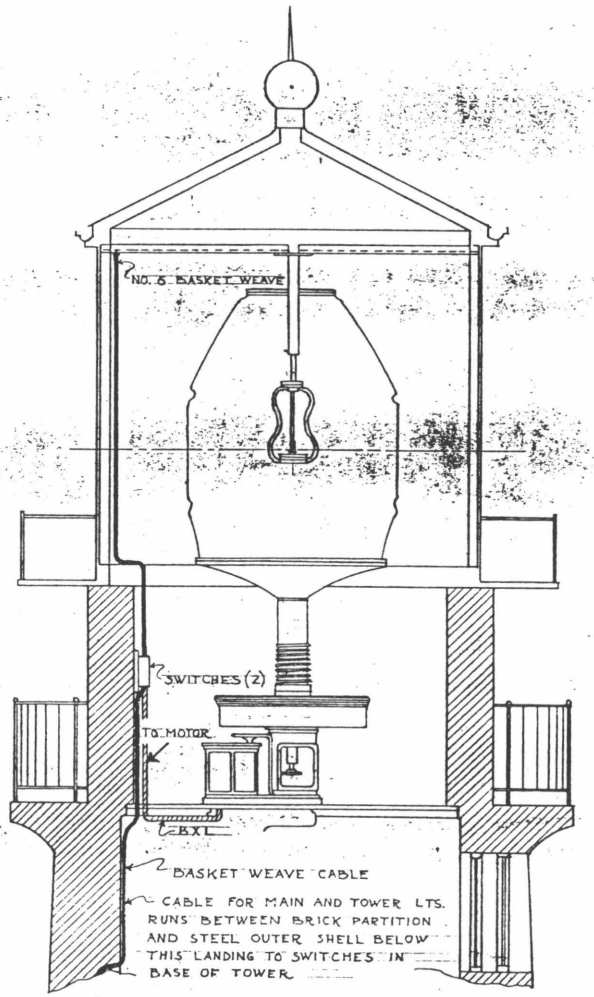
(Archives, USCG Civil Engineering Unit Providence)

Elec. Lt. Co. 3φ pole line Overhead wires
Pole with 4 pin cross arm and candulet cut out.
Dwlg
Dwlg
Tower
Concrete walls
Bolts
Lt. House
PLAN of CABLE LOCATIONS
LEGEND
330 Ft. N° 4 - 3 conductor Park cable
200 Ft. N° 6 - 2
200 Ft. N° 6 - 2
85 Ft. N° 8 - 2
50 Ft. N° 2 - 2
200 Ft. N° 18 - 2
To tower
To dwlg
Basket weave Park cable
Tirex cord for tower loud speaker.
250 amp hour battery
To motor for driving lens
To lamp stand
2-30 amp fused switches
N° 8 Basket weave cable to pedestal duct of tower.
Fused switch, in covered way
Cut-out
Twin conductor N° 6 Park cable.
To 3 Tower lts.
Reverse current relay
" Twin N° 6 Park cable
2 On main board
To present entrance switch in keepers dwelling.
2 Shunt wound generator.
3
Lighting bus
15 HP 220 V-3φ motor
Gas Eng
2 On main board
To f.s. house lts.
5 KVA dry transformer. 230-115 V-1φ
Three conductor N° 4 Park cable, to 3φ Pole line
3φ Compensator
Entrance switch
WIRING DIAGRAM
4" Bolts
5'-11"
10" Plate - 3/8"
2-2-1/4
Wires from cable along head of angle
PLAN of LAMPSTAND SUPPORT
Clockwise drive, for side
4D 48 Speed reducer
1 HP DC motor
FB 15 couplings replaced by clock type clutch
FC 12 coupling
Steel shim - a 1025
1/2" cap screws
ADB baseplate
SPEED REDUCER AND MOTOR ASSEMBLY
(LENS DRIVING UNIT.)
N° 8 Basket weave
1000 watt P.S. 52 d bulb
Switches (2)
To Motor
BXL
Basket weave cable.
Cable for main and tower lts. runs between brick partition and steel outer shell below this landing to switches in base of tower
SECTION THRU LANTERN AND WATCHROOM.
2-2-1/4 angle
Flanged base for 2" Pipe
2" Brass pipe
Twin N° 8 Basketweave
Adjustment
1-1/2" Brass pipe
Flanged base for 1-1/2" Pipe
1 Wire thru each arm to base
Fibre base for lamps
6-T. 14-250 Watt lamps, 60° apart on 4" circle replaced by 1000 watt P.S. 52 d bulb
DETAIL of LAMPSTAND AND SUPPORT
Office of The Superintendent of Lighthouses. Second District — Chelsea, Mass.
"CAPE COD LIGHT STATION. ELECTRIFICATION OF STATION.
Scale: As shown
Approved: Oct 18, 1932
Geo. E. Eaton
Superintendent
Asst. of L.H. Engr.
Drawn by: H.R.B.
Traced by: H.R.B.
Checked by:
Sheet 1 of 1
N° 692.

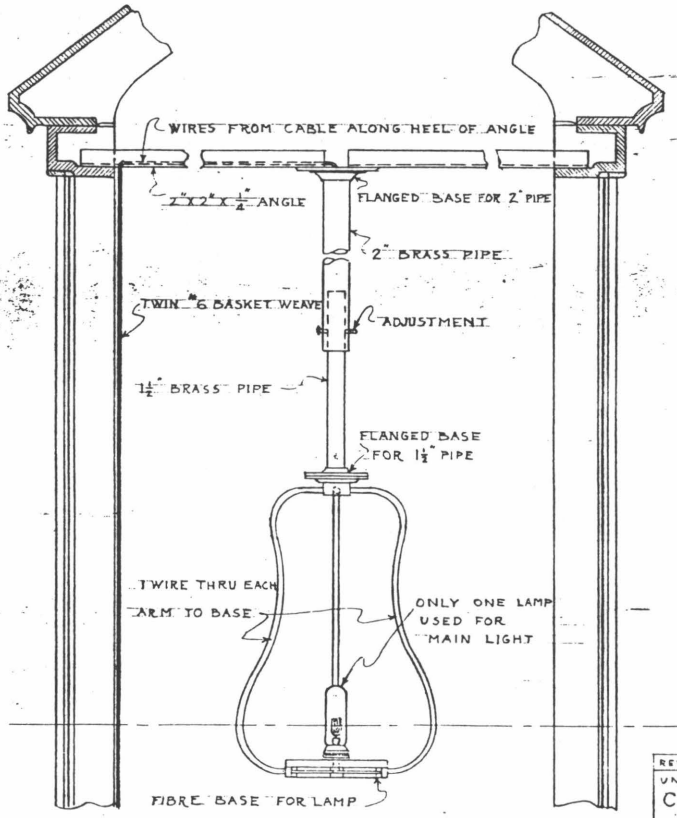
APPENDIX W.

CAPE COD LIGHT STATION
TYPE OF LAMP AND LAMP STAND, 1945

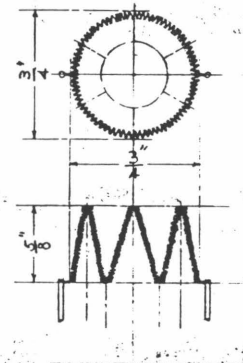
(Archives, USCG Civil Engineering Unit Providence)



SECTION THRU LANTERN & WATCHROOM



DETAIL OF LAMPSTAND & SUPPORT



1000 W. - 115 V.
T-20, CLEAR LAMP
2-C-5, RING FILAMENT
MOGUL, SCREW BASE

LAMP DETAIL COPIED FROM THIRD DISTRICT SKETCH 554C DATED NOV. 28, 1934

DETAILS FROM SECOND DISTRICT DRAWING NO. 692 SHEET 1 OF 1, DATED OCT. 18, 1932

REVISION	DESCRIPTION	BY	DATE	APPROVED

UNIT: CAPE COD LIGHT STATION

TITLE: TYPE OF LAMP AND LAMP STAND

DRAWN
TRACED CWL
CHECKED

UNITED STATES COAST GUARD
ENGINEERING
FIRST NAVAL DISTRICT BOSTON, MASS

SCALE 1" = 1'-0"

DATE 16 JULY 1945

SHEET 1 / OF 1

COMMANDER CIVIL ENGINEERING OFFICER

CAPTAIN DISTRICT ENGINEERING OFFICER 1N.B

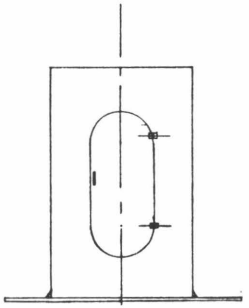
DRAWING NO. 4172

DRAWER No.

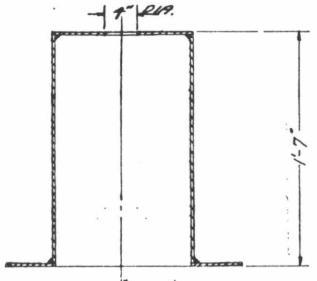
APPENDIX X.

CAPE COD LIGHT STATION, PROPOSED REPLACEMENT OF 1ST ORDER LENS WITH 36-INCH DRUM ROTATING BEACON, 1946

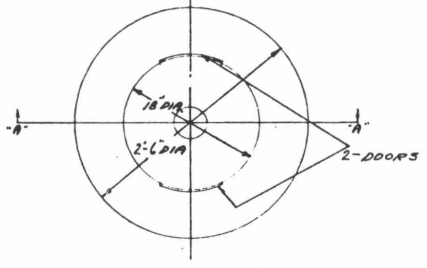
(Archives, USCG Civil Engineering Unit Providence)



ELEVATION

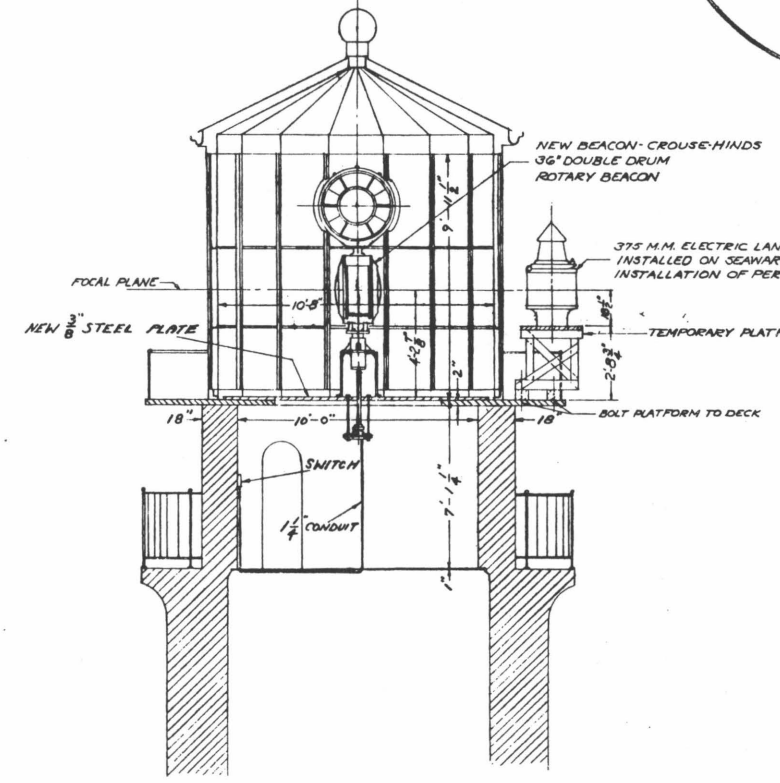


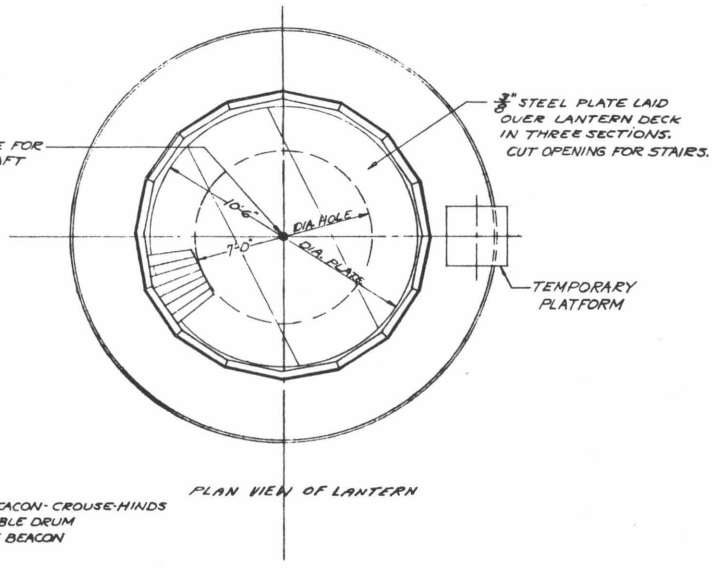
SECTION "A-A"



PLAN VIEW

PEDESTAL FOR BEACON
MATERIAL - 3/8" NEW STEEL PLATE





PLAN VIEW OF LANTERN

1	REVISED STEEL PL. CONSTR. ON LANTERN DR. INSTALLED TEMP. 375 M.M. LANTERN.	GML	10/MAR/1946
REVISION	DESCRIPTION	BY	DATE APPROVED

UNIT: CAPE COD LIGHT STA. NORTH TRURO, MASS.

TITLE: PROPOSED REPLACEMENT OF 1ST ORDER LENS WITH 36" DRUM ROTATING BEACON

UNITED STATES COAST GUARD ENGINEERING
FIRST NAVAL DIST. BOSTON, MASS.

DRAWN: W. M.
CHECKED: G.M.B.
TRACED:
SCALE: 1/2" = 1'-0"
DATE: 2-18-46
SHEET 1 OF 1
DRAWING NO. 4239

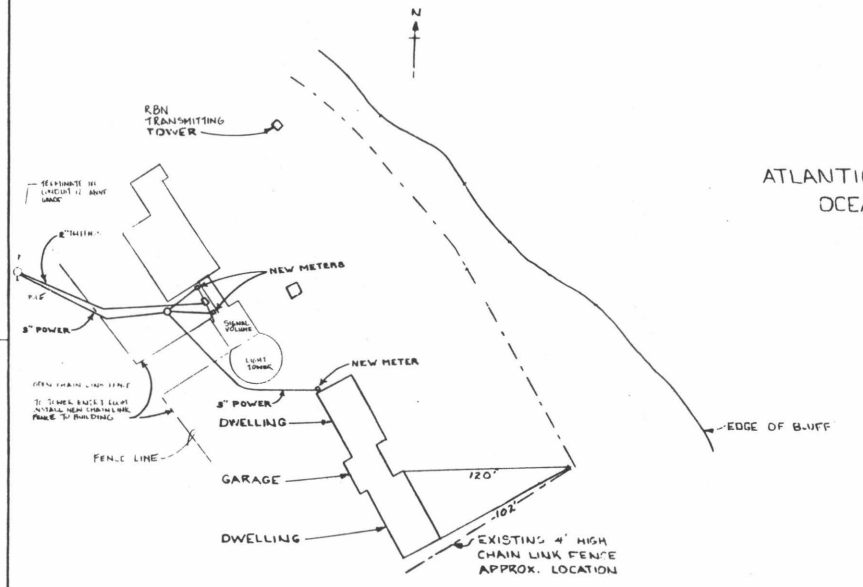
CONSTR. CIVIL ENGR. OFFICER

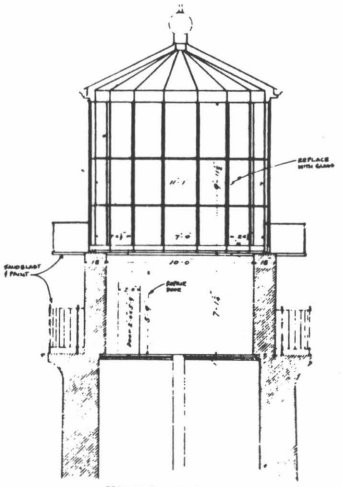
CAPT. - DISTRICT ENGR. OFFICER IND

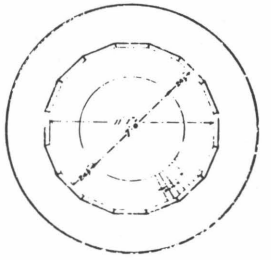
APPENDIX Y.

HIGHLAND LIGHT, CAT II AUTOMATION PLANS, 1987
(Sheets 1 and 2 of 24)

(Archives, USCG Civil Engineering Unit Providence)



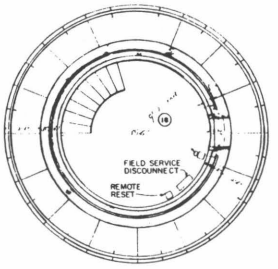




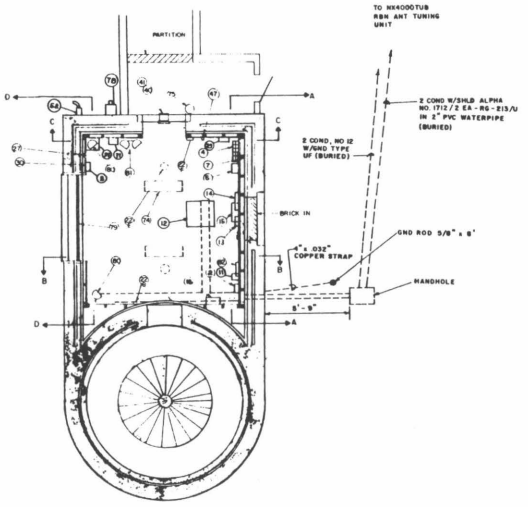
REV.	DATE	APPR	DESCRIPTION	BY
DESIGNED: Bac			U.S. COAST GUARD FIRST DISTRICT BOSTON, MASS.	
DRAWN:			ELECTRONICS ENGINEERING	
TRACED:			HIGHLAND LIGHT	
CHECKED: 11/0			CAT II AUTOMATION	
REVIEWED BY: CJC			PLOT PLAN	
REVIEWED BY:				
REVIEWED BY: CHIEF, [illegible]-DS			APPROVED: CHIEF OF DIVISION	DATE:

DRAWING NUMBER: LP6700-ICGD-40

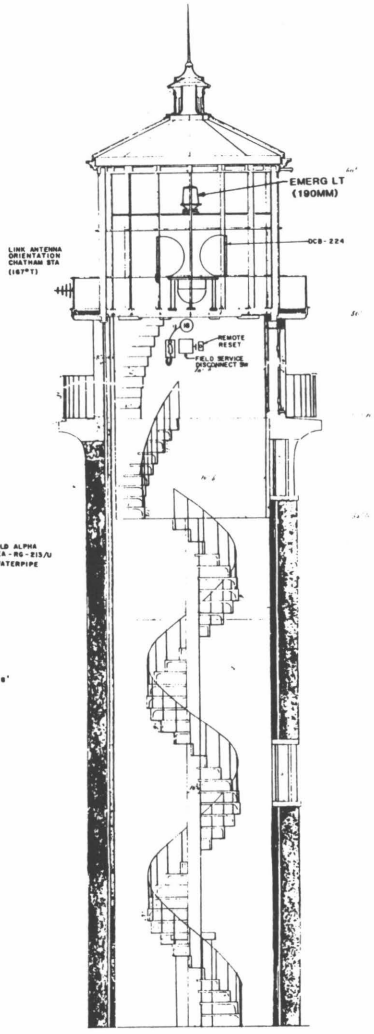
SCALE | SHEET 1 OF 24



Plan of Balcony



Ground Plan

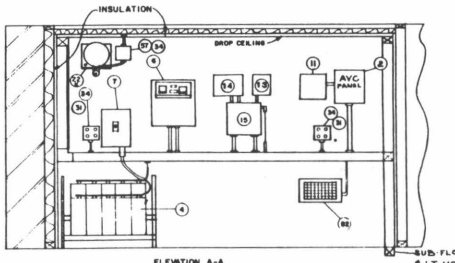


Vertical Section Over C

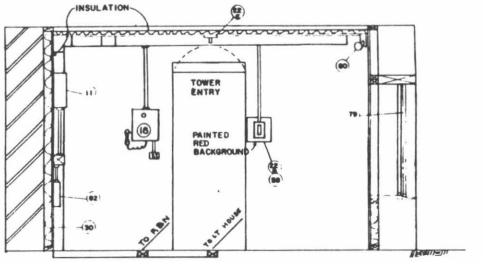
Design for Light House and Keepers Dwelling
at the Highlands, Truro, Cape Cod.

Scale Four feet to an inch.

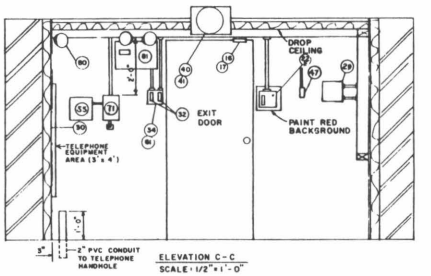
No 1585



ELEVATION A-A
SCALE: 1/2" = 1'-0"



ELEVATION B-B
SCALE: 1/2" = 1'-0"



ELEVATION C-C
SCALE: 1/2" = 1'-0"

ITEM NUMBER (26)

REV.	DATE	APPR.	DESCRIPTION	BY

DESIGNED: DEC
DRAWN:
CHECKED: MS

U.S. COAST GUARD FIRST DISTRICT BOSTON, MASS.

ELECTRONICS ENGINEERING

REVIEWED BY

DRAFT. SECT.

HIGHLAND LIGHT
EQUIPMENT LOCATION DIAGRAM

APPROVED:
CHIEF OF BRANCH

DATE:

DRAWING NUMBER
LP6700 - ICGD - 40

SCALE: AS SHOWN SHEET 2 OF 24

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Warwick, RI. U.S. Coast Guard. Civil Engineering Unit Providence.

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