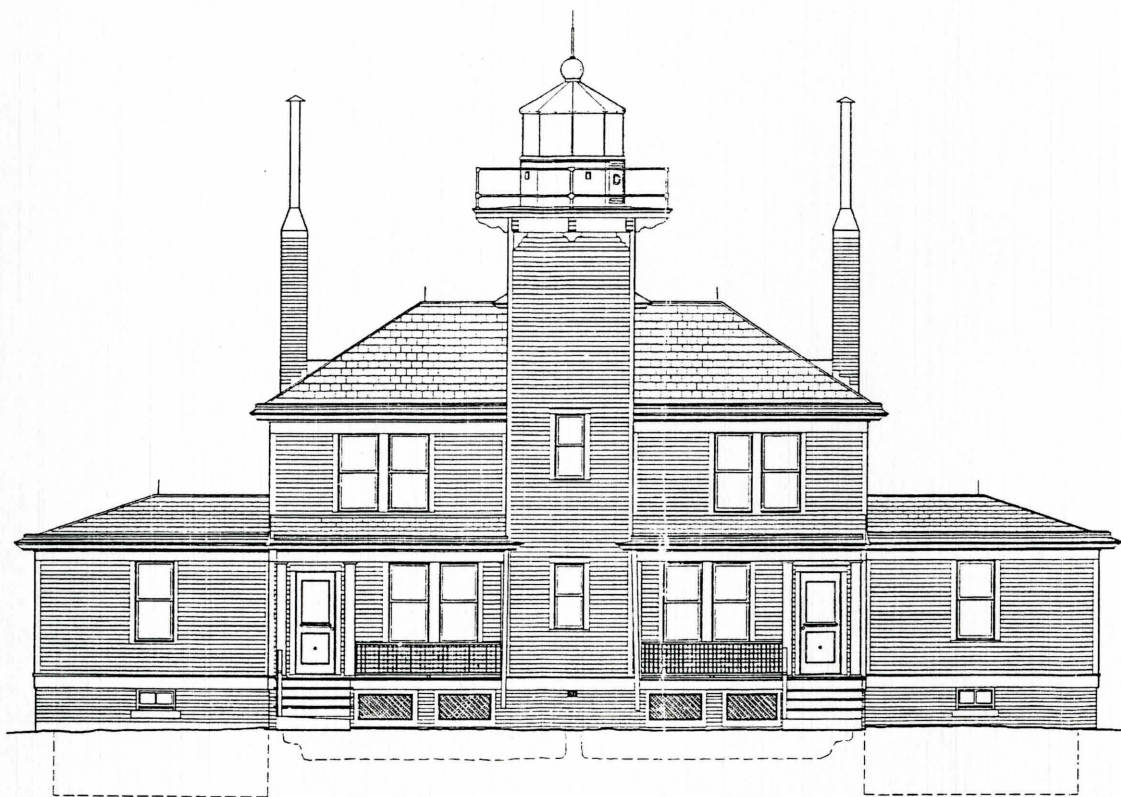


HISTORIC STRUCTURE REPORT

Raspberry Island Lighthouse

(Historic Structure 08-103A)

Apostle Islands National Lakeshore
Wisconsin



December 2000
Final Submission

QUINN EVANS | ARCHITECTS
219 1/2 North Main Street
Ann Arbor, Michigan 48104
(734) 663-5888

HISTORIC STRUCTURE REPORT

Raspberry Island Lighthouse

(Historic Structure 08-103A)

Apostle Islands National Lakeshore
Wisconsin

December 2000
Final Submission

QUINN EVANS | ARCHITECTS
219 1/2 North Main Street
Ann Arbor, Michigan 48104
(734) 663-5888

Contents

Part A: Introduction	1	Part F: Existing Conditions	61
Statement of Significance	3	Systems Analysis	63
Project Team Members	3	Architectural Barriers	67
Investigation Methodology	4	Exterior Fabric Analysis	69
		Tower	74
Part B: Historic Documentation		Interior Fabric Analysis	76
Summary	5	Keeper's Residence	79
Acknowledgment	7	First Floor	79
Historical Significance	7	Second Floor	81
History of Ownership	12	Assistant Keepers' Residence	83
Historical Background Analysis	12	Second Floor	85
Conclusion	15	Fog Signal Building (and Hoist Room)	86
		Brick Oil House	86
Part C: Archeological Research		Tramway	87
Summary	17	Boathouse	87
Archeological Investigation	19	Asbestos Testing	88
Soil Testing	19	Mortar Analysis	88
Goals and Approach	19	Paint Analysis	88
Results	19	Conclusions	89
		Part G: Design Recommendations	91
Part D: Historic Architectural		Concept Drawings	92
Analysis	21	Secretary of the Interior's Standards for	
1862 Structure	23	Rehabilitation	94
1906 Structure	26	General Approach toward Building and	
Basement	26	Site Recommendations	94
Keeper's Dwelling	27	Building Interior: South Half of the Dwelling	
Assistant Keeper's Dwelling	27	and Tower	94
General Observations	28	Building Interior: North Half of the Dwelling	94
1906 Tower	29	Building Exterior and Site Alternatives	95
Related Outbuildings	31	Recommended Treatments	96
		Recommendations for Fog Signal Building	
Part E: Building and Site		Treatments	106
Chronology	37	Part H: Research Recommendations	111
History of Alterations and Additions	39	Part I: Preliminary Design	113
Analysis of Building Episodes	39	Door Treatment Schedule	115
Conclusion	43	Design Recommendation Drawings	
Episode Illustrations	44		
Related Site Chronology	49	Part J: Preliminary Cost Estimates	117
Analysis of Site Episodes	49	References	121
Conclusion	54	Endnotes	123
Site Episode Illustrations	55	Bibliography	125
		Illustration Index and Credits	127
		Appendix A: Mortar Comparison	131

Part A: *Introduction*

Part A: Introduction

Statement of Significance

The Apostle Islands National Lakeshore comprises 69,371.89 acres on the southern shore of Lake Superior in northern Wisconsin. The park encompasses 21 of the 22 Apostle Islands and an 11-mile strip of land along the shore of the Bayfield Peninsula.¹ The Lakeshore “was established to preserve a unique geographical area, including a rich variety of natural and cultural features.”² One of these extant cultural features is the light station on Raspberry Island.

The Raspberry Island Light Station, one of six light stations established on the Apostle Islands is a significant reminder of a utilitarian yet very important profession which has ceased to exist in the United States. It is testament to the historical role of the lighthouse keeper and a distinct way of life.

Because of the relatively easy access to water transportation and docking facilities, as well as the presence of an historically significant light station, the island attracts a significant number of visitors. The station provides a general understanding of all of the light stations of the archipelago, and the important role that they once had in guiding ships safely through the waters of Lake Superior and around the Apostle Islands.

The Raspberry Island Lighthouse was listed on the National Register of Historic Places in 1977. The lighthouse is included on the National Park Service’s (NPS) List of Classified Structures (LCS), and is listed as an NPS Management Category “B” building, a structure which “should be preserved and maintained.” Its park file number and LCS number are LCS #6390; its structure number is HS-08-103A. Other structures listed on the National Register Nomination include the Light Station Dock (LCS #6391); the Fog Signal Building (LCS #6392) and the Light Station Barn (LCS #6393). Several other elements are eligible for the National Register with a State level of significance, although they were not included on the original nomination form. Projects (maintenance, construction, etc.) affecting the site must comply with “Procedures for the Protection of Historic and Cultural Environment” (36 CFR Part 800) established by the Advisory Council on Historic Preservation in accordance with Section 106 of the National Historic Preservation Act of 1966, as amended.

Project Team Members

Following the objectives of the park, the National Park Service, Midwest Regional Office, engaged the professional services of Quinn Evans/Architects, an architectural firm specializing in historic preservation, to review documentary materials relating to the history and evolution of the Raspberry Island Lighthouse, and to conduct a comprehensive survey of the existing structure. Team members providing support to Quinn Evans/Architects include: Robert Darvas Associates for structural engineering, and SWS Engineering Inc. for mechanical engineering. The team has gathered information, in addition to that which had been previously researched and collected, to formulate strategies for repair, and to recommend long range goals for the preservation/rehabilitation of the structure and its site. The results of this investigative research and documentation are contained in this Historic Structure Report. The report is arranged in the following manner:

Part A: Introduction

Documents the project team members, the scope of the project, general building location and description, and investigation methodology.

Part B: Historic Documentation Summary

Documents and analyzes historic information as it relates to the chronology of the building with summarization and reference to the *Historic Data Section* prepared by David Snyder, Park Historian, Apostle Islands National Lakeshore, and original information gathered by Quinn Evans/Architects. In addition, the summary includes a tabulated chain of title for the property to the present, and a detailed architectural analysis with historic photographs and maps.

Part C: Archeological Research Summary

Analyzes the archeological investigation of the site as it relates to the building’s chronology.

Part D: Historic Architectural Analysis

Presents and analyzes historic building chronology information gleaned from the physical investigation.

Part E: Building and Site Chronology

Presents written and graphic analysis of the building's and the site's chronology based on known historical, archeological, and physical investigatory information, with an emphasis on exterior and interior physical architectural elements; interior finishes and hardware; the history of alterations and additions; and, an analysis of each building episode.

Part F: Existing Conditions

Evaluates and documents the existing conditions of the building, including its structural and mechanical systems, and its interior and exterior materials. This section also includes a brief analysis of the surrounding site and the associated outbuildings.

Part G: Design Recommendations

Proposes design alternatives and recommendations for the restoration and contemporary use of the lighthouse building and adjacent site of the station.

Part H: Research Recommendations

Provides recommendations for further building and site investigations that are outside the scope of this report.

Part I: Preliminary Design

Includes preliminary drawings based upon Government approved design recommendations, indicating the approved final treatment of the building from alternatives proposed in Part G of this report.

Part J: Cost Estimates

Provides cost estimates for each major portion of the work to be undertaken, as proposed in Part I of this report.

This Historic Structure Report will serve as the planning document for the preservation of the Raspberry Island Lighthouse, and as the basis for the development of construction drawings and specifications for its rehabilitation.

Investigation Methodology

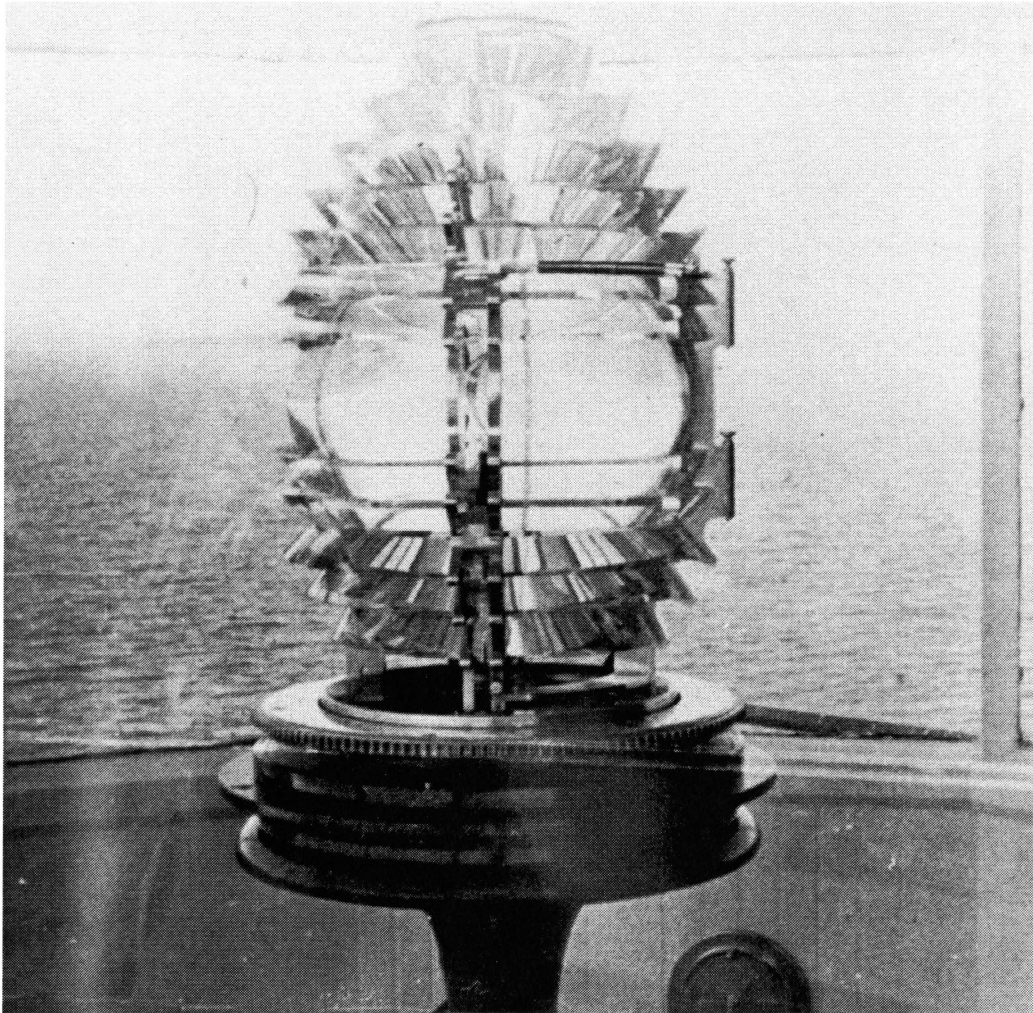
Before determining the preservation concept, the rehabilitation/restoration team conducted an in-depth study of previously researched documentary materials related to the main structure, outbuildings, and the overall site. These materials included: the 95% completed submission of a Historic Structure Report written by Enviroscience, Inc.; the "Raspberry Island Lighthouse Historic Structure Report: Historic Data Section" compiled by David L. Snyder, Park Historian of the Apostle Islands National Lakeshore; Historic American Buildings Survey (HABS) drawings; National Register of Historic Places Nomination Forms; historical backgrounds of the buildings, site, local and Great Lakes region; the historical background of the United States Lighthouse Service, including standard building practices; and, historical photographs. A thorough survey of the lighthouse and of the outbuildings, as they relate to the lighthouse, was undertaken to document each structure's architectural characteristics and construction techniques in order to gain insight into the construction and evolution of the entire lighthouse complex.

This report is based on documentary evidence collected to date, limited physical probing and destructive testing, and architectural inspection. Of necessity, the research process is not concluded with the completion of this report. Rather, it will be supplemented in the future by further information gathered through additional archeological investigation, and by subsequent documents and information as they are discovered.

Part B:

Historical Documentation Summary

Illustration 1



Fifth Order Fresnel lens at Raspberry Island Lighthouse, 1945.

Part B: Historical Documentation Summary

Acknowledgment

The historical significance of the Raspberry Island Light Station to the Apostle Islands region and the lightkeeping profession as a whole has long generated interest. Extensive historical research of the island and its structures has been undertaken in the past several years. This section is a summarization of this research and is particularly indebted to a document written by David L. Snyder, Park Historian of the Apostle Islands National Lakeshore, National Park Service, entitled, "Raspberry Island Lighthouse Historic Structure Report: Historical Data Section."

Historical Significance

In 1716, the first lighthouse in North America was constructed on Little Brewster Island in Boston Harbor. This lighthouse served as a catalyst for lighthouse construction across the United States, beginning with the Atlantic seaboard. Initially, these first lighthouses were built and maintained by colonial governments or by private organizations until August 7, 1789 when a newly formed Congress of the United States transferred the jurisdiction and administration of the lighthouses to the Federal Treasury Department under the auspices of the newly created United States Lighthouse Service.

For several years, after its initial creation, the growth and administration of the Lighthouse Service was fraught with political and administrative corruption. In 1852, a nine-member Lighthouse Board was appointed in an attempt to alleviate this corruption and maximize the efficiency of the Lighthouse Service. The Board eventually established twelve regional districts within the Lighthouse Service. The lighthouses of Lake Superior, Lake Michigan, and Lake Huron initially comprised the eleventh district, which was headquartered and serviced by a main depot in Detroit, and secondary depots around the district. By 1874, however, Lake Michigan had become part of the twelfth district.

Each district was served by an inspector, who was generally a naval officer and was responsible for the administration, personnel and inspection of the light stations. Because of technological advances and the increasing number of light stations, the Board also assigned an engineer to each district who was with the U.S. Army Corps of Engineers and was responsible for the repair, rehabilitation, and construction of the light sta-

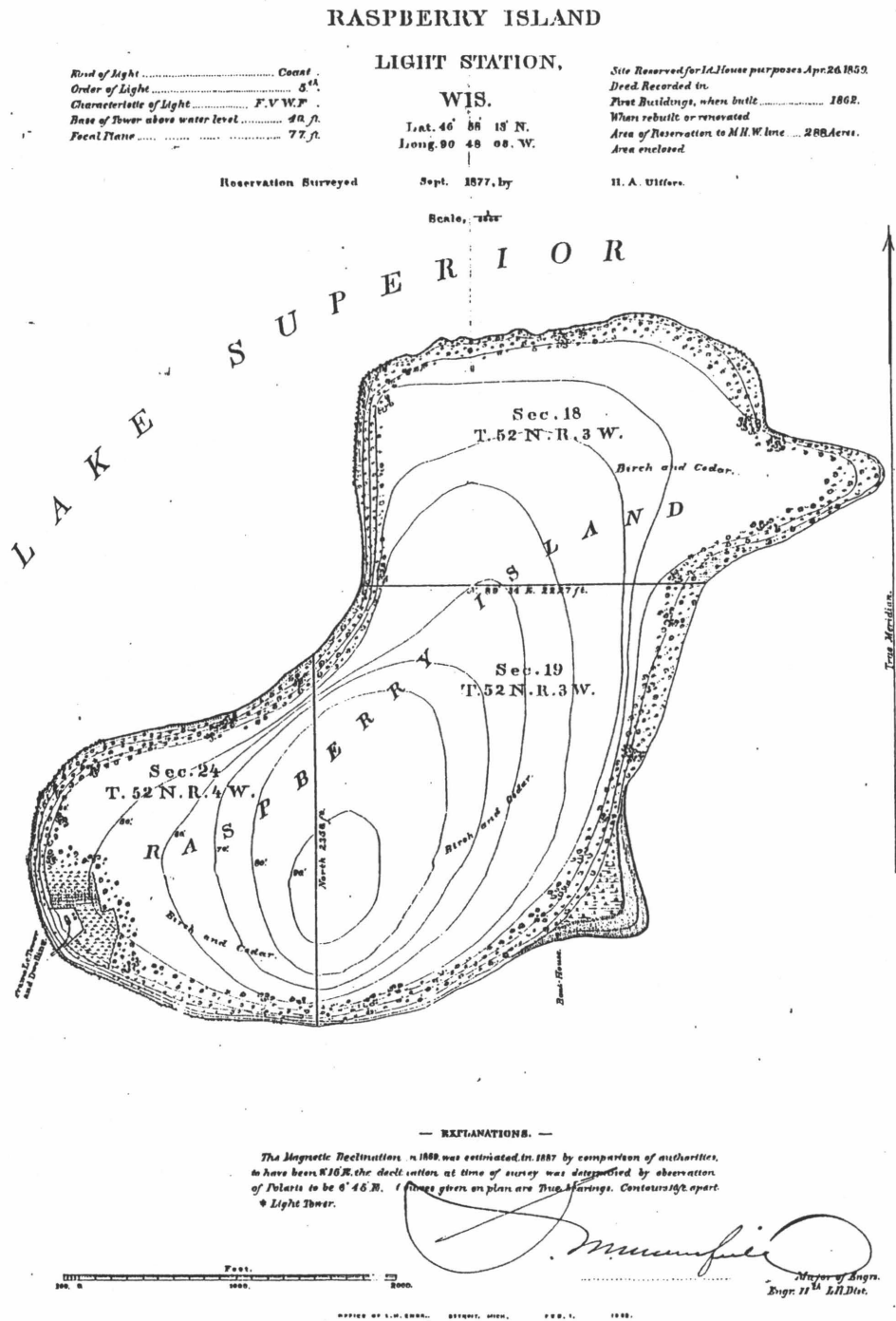
tions. Each engineer was also responsible for producing, providing, and utilizing standard designs for the lighthouses initially, and, later for the outbuildings as well. The reason why the engineer was given this responsibility was that the rapid increase in lighthouse construction made it virtually impossible to individually design each structure. Despite the use of standard designs, however, minor details were often added to the structures to give them a semblance of individuality, such as date stones, and/or additional windows or doors.

Each district employed its own U.S. Lighthouse Service crew that was responsible for the construction of the structure(s) according to the engineer's specifications. The crews were also responsible for the maintenance of all of the structures, both old and new, at the light stations.

Another change which the Lighthouse Board mandated was the installation of Fresnel lenses in all of the light stations in the country. These lenses, which had long been in use in Europe and were known to provide better illumination than those used in the U.S., were gradually acquired and installed in all U.S. lighthouses (Illustration 1). District engineers were responsible for determining the size of the lens each station within their purview would receive. This was decided according to the location of the station, and the intensity of light needed. Once this decision was made, the engineer then prepared specification drawings for the installation of the lenses. After the installation of the Fresnel lenses was complete, as well as any overhauls of the stations, the Lighthouse Service became one of the leading navigational aid systems in the world.

Soon after the Lighthouse Board instituted its changes, lighthouses began to be built on the Apostle Islands in Lake Superior. They were needed largely because there was an increase in shipping traffic, which was the result of the completion of the locks on the St. Mary's River at Sault Ste. Marie in 1855. The completion of these locks, "completed the last major link in the Great Lakes navigation system."¹ The system now comprised of the Erie Canal (opened in 1825, linking the Great Lakes to New York City and, thus, to the Atlantic seaboard via the Hudson River), the Welland Canal (opened in 1829 linking Lake Erie and the other western Great Lakes to Lake Ontario

Illustration 2



Survey map of Raspberry Island Light Station Reservation, Wisconsin, September 1877.

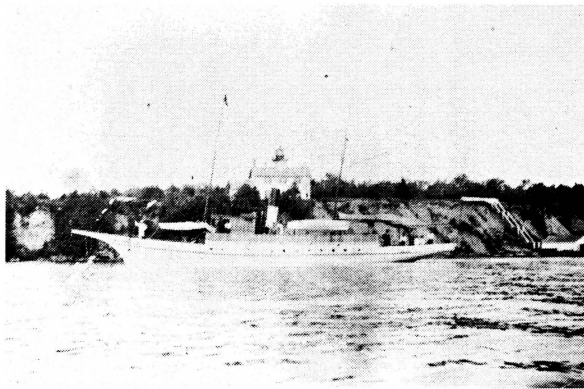
and the St. Lawrence Seaway), and the Soo locks (which linked Lake Superior with the rest of the Great Lakes).²

The countryside around Lake Superior was ripe with abundant natural resources including: timber; brownstone; copper; iron ore; and, fish. Chequamegon Bay on the lake's south shore became a major shipping point for iron ore and other resources. Naturally, with this increased commerce, new communities around the lakeshore sprang up, particularly around Chequamegon Bay, such as Bayfield, Wisconsin which was established in 1856.

With hundreds of boats plying the bay for commercial reasons as well for protection from vicious Lake Superior storms, the need for lighthouses was virtually certain. In 1858, a one and a half story wood frame lighthouse was constructed on Long Island to mark the eastern entrance of Chequamegon Bay. By the late 1850s, commerce on the lake had increased to such a degree, particularly between the western ports of the lake such as Duluth, Minnesota and Superior, Wisconsin, that another lighthouse on the western entrance of Chequamegon Bay was needed. Answering the petitions of shipping owners and lake captains on April 20, 1859, President Buchanan set aside all 296 acres of Raspberry Island as a lighthouse reservation and appropriated \$6,000 for the construction of a lighthouse on the island's south shore (Illustration 2).

The Raspberry Island Lighthouse was completed in 1862. Although the original local and regional bids exist, it is not known who actually built the lighthouse, or who was ultimately awarded the contract to furnish the lumber and supplies to construct it. In subsequent years,

Illustration 3



Photo, ca. 1895-1899 showing a lighthouse tender anchored at Raspberry Island. Each district employed several tenders to transport inspectors, engineers, maintenance crews, and materials to the light stations.

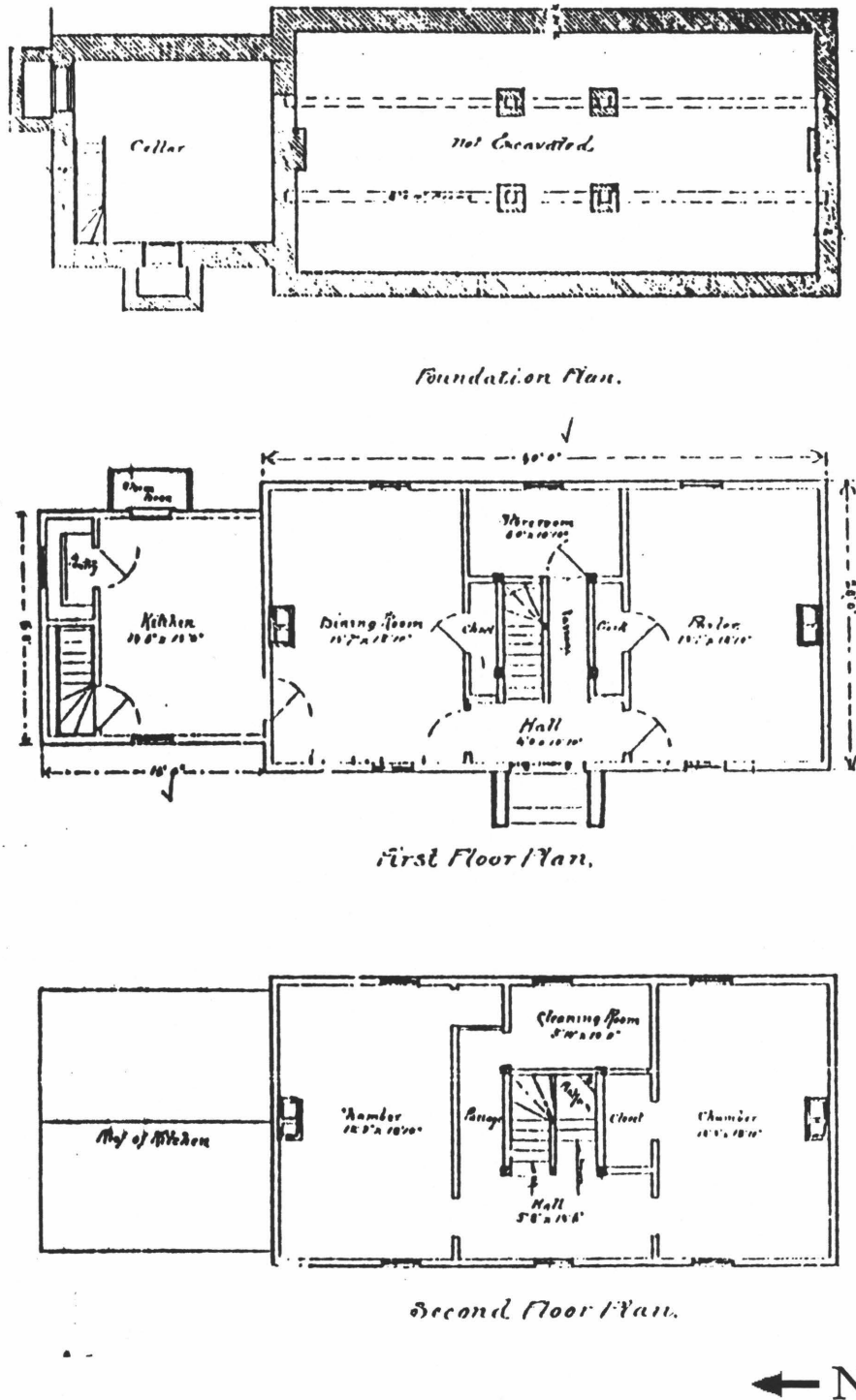
after the completion of this lighthouse, it was common for the district to solicit bids for building materials in the Detroit area, near the main depot, and then send Lighthouse Service employees out to the sites to build the structures (Illustration 3).

When it was initially constructed, the Raspberry Island Lighthouse was a two-story, wood frame dwelling with a square light tower rising from the center of its roof, and a one-story kitchen attached to the north facade. The structure, which housed the keeper and his family, had wood clapboard siding, rough stone foundations, and brick chimneys (historic plans are shown in Illustrations 4 and 5). Even though the entire structure was completed in 1862, the light was not lit until July of 1863 due to a mix-up with the Fresnel lens order. Since this initial construction, the Raspberry Island Lighthouse has undergone several changes and modifications, which will be examined in greater detail in subsequent sections of this report, however, the present structure generally has not changed from its reconfiguration as a triplex in 1906.

In 1970, the Apostle Islands National Lakeshore was established to preserve the natural and cultural resources of twenty-one of the twenty-two islands and the adjacent lakeshore of the Chequamegon Peninsula. Today the lakeshore consists of 69,371.89 acres in northern Wisconsin and encompasses six light stations, several commercial fisheries, and a nominal number of resort era buildings dating to the early 1900s. In 1975, a National Register of Historic Places nomination form was prepared encompassing five of the six Apostle Islands lighthouses, including the Raspberry Island Lighthouse. On March 8, 1977, the nomination entitled, "Apostle Island Lighthouses," was entered onto the Register. The Raspberry Island Lighthouse is designated as a Category "B" building by the National Park Service which means that it is a building that "should be preserved and maintained."

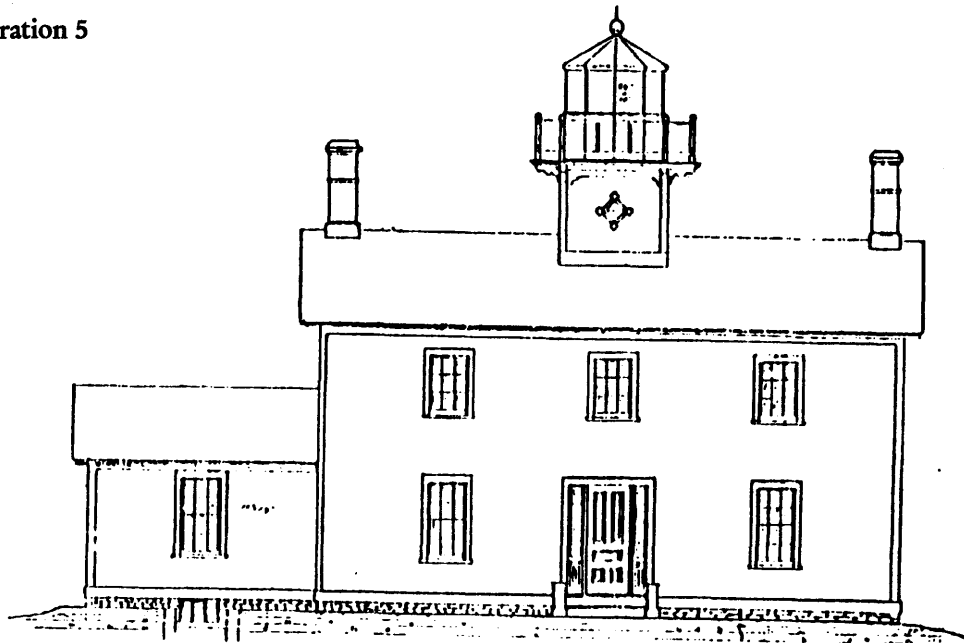
The Raspberry Island Lighthouse is one of nine structures that comprise the light station complex on Raspberry Island. The historical significance and uniqueness of the Raspberry Island Lighthouse, aside from its age, is its wood frame and clapboard construction. A majority of the Apostle Islands light stations, as well as many of those in the Great Lakes region, are of either stone or masonry construction. It is thought that the choice of wood frame construction for the Raspberry Island Lighthouse may well have been due to economic factors. Material costs for wood were significantly lower than

Illustration 4

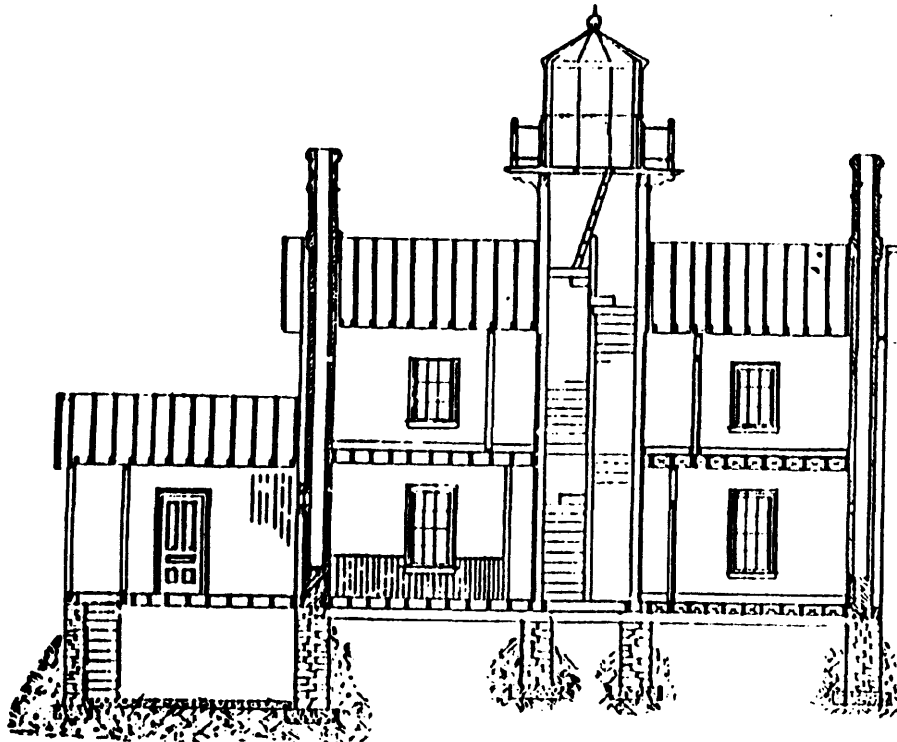


Floor plan drawings of the original lighthouse construction, 1862.

Illustration 5



Front Elevation.



Section.

Front elevation and section drawings of original lighthouse construction, 1862.

those for stone and masonry. This was an important consideration since federal money was being used to construct the lighthouse and the nation was gripped in the height of the Civil War.

Curiously, very few lighthouses and towers of the nineteenth century, particularly in the Great Lakes region, were constructed entirely of wood as at Raspberry Island. The National Park Service says in its document entitled, *1994 Inventory of Historic Light Stations*, that "the most common construction material for existing historic towers is brick; the second, cast iron."³ In fact, of the existing historic towers, 11.1% are wood while 31.7% are brick, 20.6% are iron, and 19.5% are stone.⁴ The majority of the lighthouses of wood frame construction are found along the eastern seaboard. These structures also typically display a centrally located light tower. Both the wood construction and the centrally located tower are features of the original Raspberry Island Lighthouse. Also like many of the east coast lighthouses, Raspberry Island is perched atop a high bluff overlooking the water.

History of Ownership

When Congress set aside the 296 acres of Raspberry Island as a lighthouse reservation on April 20, 1859 the land became the property of the United States Government. Prior to the Government's ownership, it is not believed that the land was owned by anyone. Early French explorers and missionaries did visit the region in the 1620s, but there is no known record of ownership, deeds or surveys of the land.

While the Government continues to own Raspberry Island to this day, responsibility for the management of the land and structures has fallen within the jurisdiction of four different government agencies over the course of Raspberry Island's existence. When the land was first acquired, it was placed under the jurisdiction of the U.S. Treasury Department which in turn had created the United States Lighthouse Service to administer the lighthouses throughout the country. The Treasury Department retained control until 1903, when jurisdiction went to the Commerce Department. Under the Presidential Reorganization Act of 1939, the Lighthouse Service became part of the U.S. Coast Guard. In 1958, Raspberry Island was leased to Ellerbee Architects, an architectural firm in Minneapolis, Minnesota, as their corporate retreat. At that point the lighthouse had been vacant for almost ten years. Apparently, as part of

their lease with the Coast Guard, the firm was allowed to remodel the lighthouse, but was also responsible for maintenance of the site. For the next seventeen years, the firm hired Bayfield residents as on-site caretakers of the island.

Around 1970, the Coast Guard transferred its jurisdiction of Raspberry Island to the Bureau of Land Management. Then, in late 1975, after several delays, the National Park Service took possession of the island. The Park Service continues its jurisdiction over the island today. Recently, plans have been prepared not only for the exterior and interior restoration of the lighthouse, but for the refurbishing of it as well.

Tabulated Chain of Title for Raspberry Island

1859 - 1903	U.S. Department of the Treasury, U.S. Lighthouse Service
1903 - 1939	U.S. Department of Commerce, U.S. Lighthouse Service
1939 - 1970	U.S. Coast Guard
1970 - 1975	U.S. Bureau of Land Management
1975 - Present	U.S. Department of the Interior, National Park Service

Historical Background Analysis

A light station typically consisted of a complex of interdependent structures, and was clearly and deliberately designed for utilitarian purposes. The light required a keeper who not only would replenish its fuel, but who would also maintain and operate it on a daily basis. Because of these time-consuming responsibilities, and the overall nature of the job, the keeper needed a place to live and, perhaps, transportation. Thus, in addition to the light tower, one often finds a dwelling, a fog signal building, a privy (or multiple privies), and multiple storage buildings, including: one or more cisterns for water storage; a fireproof oil house for the storage of flammable fuels; and, some form of transportation storage, usually a boathouse, stable, or garage depending upon the location of the light station. At the very minimum a station would have a tower housing both the light and living quarters for the keeper.

The original keeper's dwelling on Raspberry Island was a large, two-story structure built in 1862 with an attached one-story kitchen and an integral four-story square light tower rising from its center. Lighthouse design changed gradually throughout the nineteenth century,

with several distinct design types emerging. According to Charles K. Hyde, author of *The Northern Lights*, “the most common design [in the Great Lakes] until around 1870 consisted of a keeper’s dwelling of wood, stone, or brick, with the light exhibited in a lantern built into the roof or mounted on an attached square tower.”⁴ In this respect Raspberry Island appears to represent typical lighthouse construction of the period. What differentiates it from its counterparts, however, is the location of its attached tower in relation to the dwelling. Typically the location for the attached tower was along the perimeter of the dwelling, usually at the longitudinal end, but Raspberry Island’s tower rose from the center.

By the 1870s, taller towers, which could provide a higher focal plane of light, were required at many stations and often a new brick or stone conical tower was constructed and attached to the existing dwelling by a passageway. These new towers were between eighty and one hundred feet tall. Because Raspberry Island was perched high atop a sandstone bluff, and already had a focal point of seventy-seven feet above the low lake level, a new tower was not needed. The lighthouse did require additional housing though, following the construction of the fog signal building in 1903.

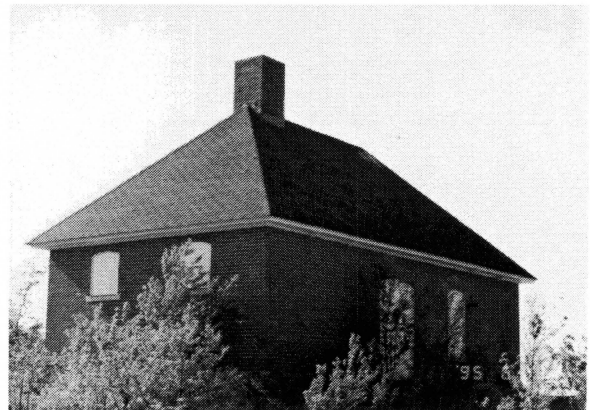
The new demands placed on the light station, as a result of the fog signal, required an increase in staff. So, in 1906, several alterations were made to the dwelling in order to accommodate the new assistants and their families. The alterations included: an addition to the dwelling, the removal of the original tower, and the construction of a new one along the perimeter of the dwelling. The new tower’s design not only utilized the lantern from the original tower, but also mimicked the original tower in its square shape, wood construction, and clapboard siding. As was true of the dwelling at Raspberry Island, the new tower did not conform to the standard Lighthouse Service designs then being used in the Great Lakes region, such as the conical shape and the use of stone or masonry construction.

The Raspberry Island Light Station consists of nine primary structures which include: the keeper’s dwelling with attached light tower; a fog signal building; a brick oil house; a boathouse (with docks); two privies; a wood shed; a “cabin” or “shack” as it has been referred to; and, a one and a half story warehouse. In addition, there is a concrete tramway with a tram and hoisting engine for the transportation of supplies between the docks at lake level and the light station situated on the bluff approximately

40 feet above. Secondary elements include the concrete sidewalk system, flagpole, and concrete oil cradles/saddles.

Each of the structures had a distinct role in the operation of the light station, and were often interdependent. While the lighthouse itself was of primary importance, the fog signal building, once built, also played an essential role especially when fog or smoke rendered the light useless. Since this was often the case in the Great Lakes region, fog signal buildings were constructed at a rapid rate during the last half of the nineteenth century. As with the lighthouses, the district engineer developed standard designs for the fog signal buildings in his territory. The result was that many of the fog signal buildings in the region were virtually identical,

Illustration 6



Fog Signal Building, Au Sable Light Station, Lake Superior.
Constructed 1897.

Illustration 7



Fog Signal Building, Raspberry Island Light Station, Lake Superior.
Constructed 1903.

Illustration 8



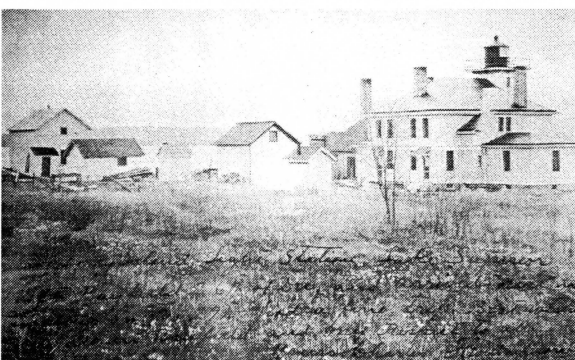
View of Raspberry Island Light Station from the water, ca. 1901 - 1903. Note the shed addition at the entrance to the lighthouse, and the lack of structures on the cleared reservation.

Illustration 9



View of the Raspberry Island Light Station from the water, ca. 1920. Note the additional structures since ca. 1901 - 1903 (Illustration 8) including: the fog signal building, tramway, new light tower and lighthouse addition, and two outbuildings.

Illustration 10



View of the Raspberry Island Light Station from the rear (east) edge of the site, ca. late 1906.

albeit with a few minor differences or alterations (Illustrations 6 and 7).

Illustration 8 shows the light station as it appeared prior to 1902. The fog signal building has not yet been built, and the lighthouse appears as it was originally constructed. The only discernible structures are: the wood stairs, which led from the lake up the bluff to the lighthouse; the boat docks; and, the boathouse.

Illustration 9 shows that, by 1920, the station had several outbuildings, including a wood tramway and tram used for moving supplies up the bluff from the water; the fog signal building with an attached structure for the winch which powered the tram; a one and a half story warehouse; and, the shadow of a structure which may have been the "hard coal house" referred to in a 1915 journal entry. It also shows the additions and alterations made to the lighthouse in 1906, including the new light tower.

Illustration 10 is a rear view of the site looking southwest which reveals that the site had reached its peak development by circa late 1906 (and has remained relatively unchanged since that time). Discernible structures include: the lighthouse with its 1906 additions and alterations; the whistle shed; the one room storage building referred to as the "shack;" the one and a half story warehouse at the far southeast corner of the site. One noticeable difference from this photo compared to the site today is that the lean-to attached to the north elevation of the one and half story "warehouse" no longer exists.

Although "lighthouses" are considered an architectural type in and of themselves, much of their design, particularly the dwelling portion, appears to have been influenced by period residential structures. It is not surprising then that some elements of late 19th century residential construction appear at the keeper's dwelling on Raspberry Island, such as the clapboard siding and decorative pressed metal roof. Decorative pressed metal shingles were very popular residential construction materials, and were advertised as being: superior for roofs with a steep pitch; fireproof; "unbreakable;" and, were said to not come loose with expansion.⁵ The shingles were typically either steel, tin, or copper. If the metal was not galvanized then the shingles were kept well painted in the color of choice which, at that time, was red.

The most noticeable impact that late 19th century residential design had on the dwelling at Raspberry Island was the internal organization of space. This organization reflects the “classical box” massed plan, as depicted by Virginia and Lee McAlester in *A Field Guide to American Houses*, and shown in Illustration 11. Developed in New England around 1760, the plan consists of an equal division of space into four sections at each floor with an equally sized central circulation core. The exterior of the structures typically reflected the symmetrical composition of their interiors. Illustration 12, for example, shows the exterior of a typical New England style folk house of the late 18th century. Note the symmetrical fenestration pattern and the placement of the door and chimney.

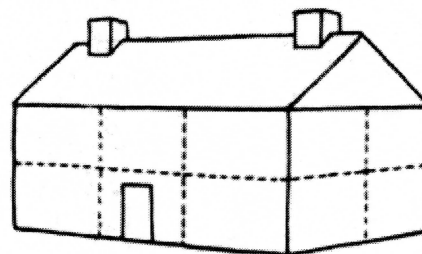
As New Englanders migrated north and west, so too did their architectural styles and designs. By the mid-nineteenth century, Colonial, Federal, and Greek Revival style houses with their massed plans, (which were modified versions of the “classical box”) could be found throughout the Midwest. Thus, when the Raspberry Island Lighthouse was constructed in 1862, the styles were already well integrated and common to the Great Lakes region.

Analysis of the construction drawings for the 1906 modifications of the lighthouse at Raspberry Island, as well as physical observation of its extant materials, reveals that most of the original foundation, and some of the 1862 wood framing, was left intact within the 1906 structure. The changes initiated in 1906 appear to be loosely based on the Colonial Revival style, and, as such the original 1862 structure lent itself, in part, to these changes. The 1906 modifications to the Raspberry Island lighthouse evolved out of the original colonial style that was adapted for the new requirements of three separate living quarters. Even though the tower was relocated and the interior stairs rebuilt, the 1906 structure maintains the central core (albeit divided) for circulation, with the flanking spaces used as living quarters.

Conclusion

The overall massing, internal organization and stylistic influences of the lighthouse at Raspberry Island were likely not intentional, but rather a reflection of the architectural and design trends in the region at that time. However, the retention of parts of the original 1862 structural fabric in the 1906 modifications, appears to have been deliberate.

Illustration 11



Axonometric diagram of the “classical box” massing typical of many 18th and 19th century homes.

Illustration 12



Photo of the Redfield House in Meriden, Connecticut, which is an early example of the “classical box”.

Part C: *Archeological Research Summary*

Part C: Archeological Research Summary

Archeological Investigation

The only existing archeological report concerning the Raspberry Island Lighthouse was prepared by Vergil E. Noble, Archeologist for the National Park Service. The report documents his archeological investigation undertaken from September 24 through 28 of 1990. The following is a summarization of that report.

Mr. Noble, archeologist of the Midwest Archeological Center of the National Park Service, traveled to Raspberry Island to participate in structural investigations of the lighthouse. He said that "the physical examination of that building was required in order to gather information on its existing condition as part of the planning process for its restoration."¹ Mr. Noble's primary role in the structural investigation was to ensure that any archeological resources were recorded and not destroyed during the investigative process.

Ground disturbance was limited to four excavations against the exterior foundation walls, and four additional excavations against interior sections of the same walls within the dirt crawl space floor beneath the main structure and light tower.² The report states that, "although no archeological deposits of consequence were encountered, important information pertaining to the structural evolution of the lighthouse was revealed."³

As evidenced by archeological research conducted at other light stations in the Great Lakes region, the potential for retrieving cultural artifacts is extensive and further archeological investigations are recommended for a better understanding of the Raspberry Island site.

Soil Testing

Goals and Approach

In addition to the previously mentioned archeological report, a geotechnical exploration program was undertaken at Raspberry Island by Twin City Testing Corporation of Duluth, Minnesota under contract with Enviroscience, Inc.

The scope of services included:

1. Observation of (4) excavations next to the existing structure. The excavations were to extend to footing depth.
2. Obtain a thin wall sample of soil at footing depth from excavations.
3. Perform a limited amount of laboratory testing to assist in the classification of the materials and the characterization of the engineering properties.
4. Provide an engineering report including: observations of the excavations, results of the laboratory tests and engineering opinions, and recommendations for the following:
 - A. Allowable soil bearing pressures
 - B. Foundation Recommendations
 - C. Backfill Recommendations
 - D. Drainage Recommendations

It was noted that the intention of the program was not to determine the presence or extent of contamination at the site.

Results

Four excavations were performed at the site by the National Park Service and a Twin City Testing engineer on September 24, 1990.

All four of the excavations exposed a surficial topsoil, underneath which was a clay fill with sand and gravel. Cobbles, construction debris, and tree roots were also observed in each of the excavation pits.

Excavation #1 was performed at the northwest corner of the lighthouse extending to a depth of 3'-6" and adjacent to a 2' x 2' porch support. Here, Enviroscience observed that, "due to clay soil expansion, a pervasive adverse condition, the bond between the porch pier brick and mortar has broken resulting in a lateral displacement of 1-1/2" from original position."⁴ This condition is assumed to exist at all six piers.

Excavation #2 was performed in the southwest corner of the structure. It extended 6'-0" below grade and exposed a 5'-0" brick wall resting on a 1'-0" thick footing. This excavation revealed some light moisture-related powdering of the brick. In addition, a clay drain tile was also observed at the top of the concrete footing.

Excavation #3 was performed at the northeast corner of the lighthouse, and extended to a depth of 6'-0". Here gravel was exposed beneath the 5'-0" depth of clay fill. The concrete block wall that was constructed along the entire east basement wall in 1977 by the National Park Service was also observed. Enviroscience states, "Associated copper flashing has decayed, perhaps due to incompatibility with the clay soil."⁵ Two PVC pipes were also exposed, one at a depth of 2'-0" and the other embedded in gravel 5'-6" below grade.

Excavation #4 was performed at the southeast corner of the structure, and extended 6'-6" below grade. This excavation exposed a 5'-6" deep brick foundation wall resting on a 1'-0" concrete footing as at excavation #2 and a clay drain tile at 6'-0" below grade.

Groundwater only appeared in one of the four excavations, and that was excavation #2. It was noted that the on-site soils were considered to be very slow-draining materials, and that it would take a long period of time to determine groundwater levels. As Twin City Testing states, "the lack of an observed water level at the time of excavation does not necessarily indicate that the water level is beneath the explored depth."⁶

Part D:

Historic Architectural Analysis

Illustration 1



Aerial view of the Raspberry Island Lighthouse Complex ca. 1940s.

Illustration 2



Aerial view of the Raspberry Island Lighthouse Complex ca. 1990s. Note the similarity to Illustration 1. There has been little change to the historic site immediately surrounding the structures since the 1930s.

Part D: Historic Architectural Analysis

Whereas little change has taken place at the lighthouse itself since 1906, the entire site of the Raspberry Island Light Station has remained relatively unaltered since 1931, with most alterations taking place only at the interiors of the individual buildings. The site and exterior of the Raspberry Island Lighthouse appear much the same today as they did in 1931. This can be seen by comparing Illustration 1 of the 1940s (just ten years later) with Illustration 2 of the 1990s (over 50 years later). While most of the extant building materials date to the 1906 expansion of the lighthouse, some of the original 1862 fabric also remains.

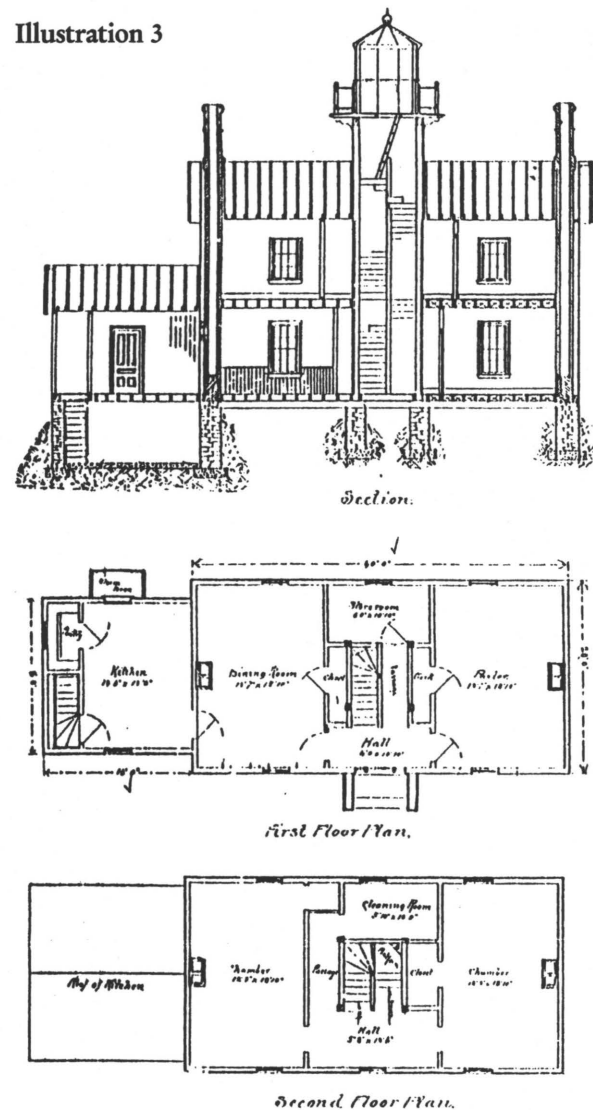
1862 Structure

The original Raspberry Island Lighthouse was constructed in 1862, and consisted of a large, two-story, single-family dwelling with a four-story square light tower rising from its center. The two-story building was approximately forty feet by twenty feet. The interior was centrally divided by a stair hall, which provided access to the second floor of the dwelling as well as to the top of the light tower. This hall was flanked by the dining room and parlor at the first floor, and the sleeping chambers at the second floor. A one-story addition, sixteen feet square in dimension, and attached to the north end of the main structure, was built at the same time, and contained the kitchen (see Illustration 3).

As evidenced by historic drawings and physical investigation, the foundation of the original structure consisted of rough stone walls ranging in thickness from 18" to 2'-0". Although no longer extant, the historic 1862 drawings of the original structure indicate that the only excavated space originally was beneath the one-story kitchen, which was used as a storage cellar. Several painted white stones above the current floor (as seen in Illustration 4) are the only extant remains of this whitewashed cellar, as was indicated in a journal entry of 1897, which states something about "White-washing the cellar..."¹

The exterior wall surfaces of the original structure were covered with wood clapboard siding and 4" corner boards, as revealed in a photo dating to 1862 (Illustration 5). Also, the roof surface in this photo appears grainy which may indicate that the original roof shingles were possibly a rough material such as wood shakes. An entry in the keeper's journal of 1901 states that the roof of the lighthouse was reshingled. This may be the date at which stamped sheet metal shingles were first

Illustration 3

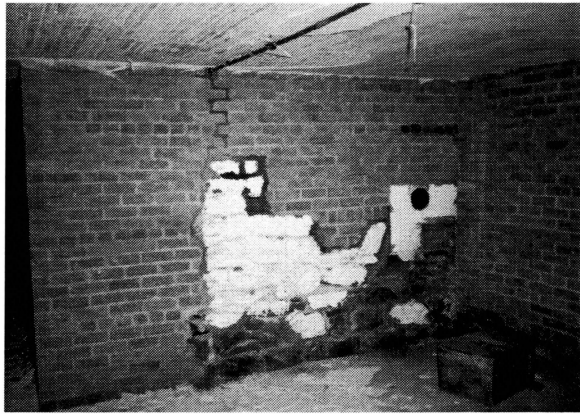


Drawings of the original lighthouse construction, ca. 1862

installed at the lighthouse. Illustration 5 also shows the decorative profile of the brick chimneys above the roof line. It is assumed that the entire roof was reshingled (with the extant stamped sheet metal shingles) in 1906, following the extensive alterations to the structure.

The first floor windows were six-over-six double hung wood sash. The windows at the second floor were three-over-six with the upper sash approximately half the height of the bottom sash. All of the windows had wood shutters, a feature that disappeared with the construction alterations of 1906. Illustration 6 also reveals one single

Illustration 4



View of the basement looking south, 1995. Note the white paint that is the original 1863 cellar finish.

Illustration 5



View of the original lighthouse looking northeast, ca. 1890s. Note the decorative profile of the brick chimneys and the wood shutters, both of which are no longer extant.

Illustration 6



View, ca. 1903-1905, looking southeast at the 1862 lighthouse and 1903 Fog Signal Building. Note the details of the "kitchen wing" at the north end of the dwelling, which was demolished in 1906.

pane casement window on the north elevation of the one-story kitchen wing. Although no historic photographs of the original east elevation exist, the historic drawings (Illustration 3) indicate that the fenestration pattern of the east elevation was identical to the west elevation with the exception of the center door opening which was replaced with a window. The section drawing in Illustration 3 also indicates that there was an exterior door on the east elevation of the one-story kitchen wing. By contrast, there were no windows on the south elevation of the dwelling (Illustration 5).

The paint analysis suggests that the early exterior white paint layers ranged between off-white and true white. This variation most likely occurred between different cans of paint and by the natural aging of the linseed oil in the paint. While typical color schemes of the era suggest that the color of the board siding was white and the trim, including the corner boards, skirt boards, and fascia were painted a dark color, the exact colors are not known, as only black and white photographs exist.

The main entrance into the lighthouse was at the center of the west elevation. The door appears to have been a 5-panel wood door. This panel configuration is somewhat unclear because in each historic photo the door has an exterior two-panel screen/storm door in front of it. The door was flanked on each side by a six-pane sidelight, as can be seen in Illustration 7. Two wood steps led to a stoop, which appears to have been supported on wood "wing" walls. Illustration 6 indicates that a wood storm shed, or lean-to, was constructed and attached to the facade at this entrance. This storm shed was constructed, along with several other small jobs, by a construction crew who worked at the lighthouse for a six-week period during the 1901 season, as indicated in the keeper's journal of that year.

The original light tower was square in plan and was located at the center of the dwelling. Above the dwelling's roof, the exterior walls of the tower were white clapboard siding with gray corner boards. There was a diamond-shaped window with gray trim at the center of the west face. Illustration 8 shows the original tower and lantern. The platform was eight-sided and had a wood balustrade with decorative newel posts. The brackets supporting this platform were similar in profile to those of the existing tower. The lantern itself appears identical to the present lantern, suggesting that it was relocated to the new tower that was constructed in 1906.

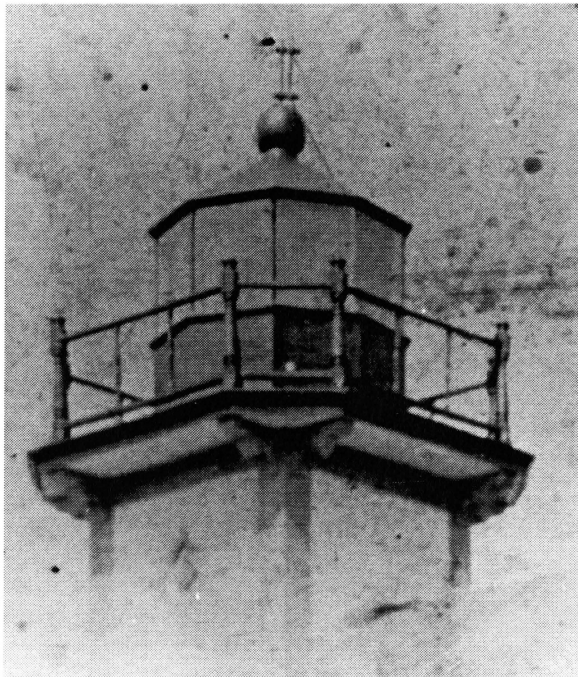
Illustration 7



West facade of the 1862 Lighthouse, ca. 1900-1901. Note the original entrance detail with sidelights.

The only extant evidence of original interior finish materials observed during physical investigation were the floor boards of the west section of the dwelling at the second floor. As seen in Illustration 9, the original floor boards are laid in a north-south direction, and end at the location of the original east exterior wall, which was demolished to expand the structure in 1906. The 1906 boards, however, are laid in an east-west direction, perpendicular to the original boards. The end result is that both the original boards and 1906 boards abut in a flush joint that is visible the entire width of the structure. There is no evidence of a break or change in the structure at the walls or ceiling at this location, suggesting that both were replastered at some time following the 1906 alterations. Additionally, the first floor rooms appear to have been refloored, as the floor boards are continuous throughout the west rooms, run in the same direction without interruption or changes, and are similar in size and material to those in the rooms that were added in 1906.

Illustration 8



View of the original tower and lantern, ca. 1895-1899. Note the eight-sided deck with wood balustrade and handrail. The diamond window on the west facade can also be seen, with the brackets that are slightly different from those today.

The division between the 1862 and 1906 construction is also visible in the attic framing. The attic floor joists of the 1862 structure run in an east-west direction while the floor

Illustration 9



View of the floor in Room 204 looking southeast, 1995. Note the flush butt joint where the 1906 floor boards meet the 1862 boards, and the ghosting of a former linoleum piece on floor.

joists of the 1906 east addition run in a north-south direction. Again, the result is that the original boards and 1906 boards abut perpendicularly, as occurred on the second floor.

1906 Structure

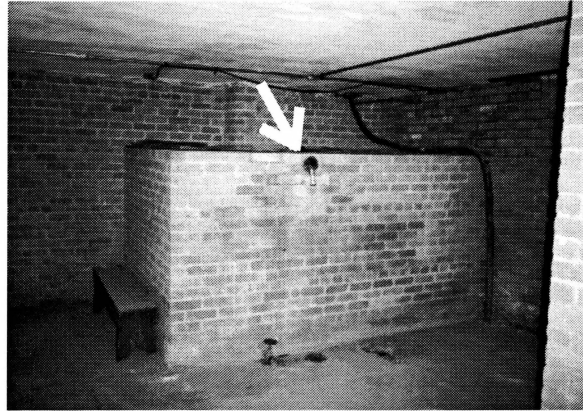
Basement

Physical investigation revealed that much of the 1906 structure was constructed with accuracy relative to the drawings of 1905. The 1906 perimeter foundation walls are 15" thick, consisting of two outer brick wythes, and one inner brick wythe with an air space in between. These walls are laid in stretcher bond. The brick foundation walls encompassing the crawl space and incorporating the former stone foundation walls are 12". These walls are laid in common bond with nine courses of stretchers to each course of headers. The headers most likely span the air space, structurally tying the single outer and inner brick wythes together.

Below ground demolition and construction included: the removal of the original cellar; excavation of the space underneath the original dwelling to create a 5'8" deep crawl space; and, construction of a 7'1" deep basement beneath the 1906 addition. The basement was divided into two separate spaces that were mirror images of each other. Each space had its own stair to the first floor, its own access into the crawl space, and its own brick cistern which stored water for use in the kitchens directly above. Both cisterns were constructed along either side of the brick wall that centrally divided the basement. The "Detailed Description of Premises" of 1910 states that each cistern was lined with cement and contained a brick filter. Additionally, each cistern had a lead pipe that ran from the cistern to the respective kitchen sink above, as seen in Illustration 10. The 1906 drawings indicate that all six downspouts along the east elevation fed into drain pipes which, in turn, emptied into the two cisterns.

Currently there is wood shelving along the north wall of the south half of the basement. Although it is often assumed that kerosene was stored in outbuildings, this shelving may also have been used to store kerosene. This is highly probable because for the first 21 years that kerosene was used as fuel for the light, there was not a proper storage facility built for the highly flammable fuel. This may also explain why the entire basement ceiling, including that in the crawl space, was finished with plaster. Plaster was a common form of fire protection during this period.

Illustration 10



View looking north at the cistern in the south half of the basement, 1995. Note the remains of the lead pipe which led to the pump in the kitchen above.

Furthermore, physical investigation revealed an exposed area where the joists and underside of the floor structure are painted white, suggesting that the extant plaster was not the original ceiling finish.

It appears that when the materials of the original structure were dismantled for the 1906 alterations, those that were salvageable were reused in the new construction. Materials that may have been salvaged include: the wood siding, the trim, and the metal roof shingles.

Other noticeable changes made to the original structure involved the chimneys and windows. While Illustration 5 shows a decorative profile of the brick chimneys above the roof line, Illustration 11 does not. This suggests that the chimneys were rebuilt in 1906, albeit in their original locations utilizing the existing stone foundations. Another feature which disappeared in 1906, were the wood shutters that were originally hung at all of the windows.

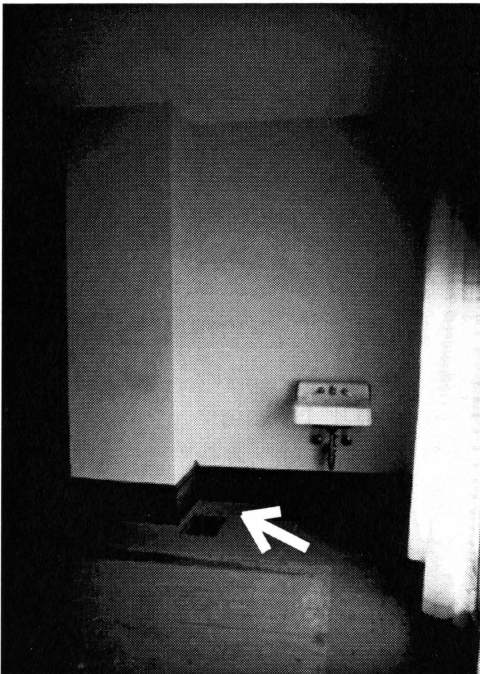
Furthermore, the paint analysis further provides some information on the lighthouse's later paint scheme. The analysis revealed that at least one of the original layers of paint on the screen doors (currently stored in barn) and the window screens was dark green in color. In most cases there is only one layer of dark green suggesting that this color was used only for a short period, and that the color of choice was mainly dark gray.

Illustration 11



Overall view of the west elevation of the lighthouse, 1995.

Illustration 12



View of the southeast bedroom on the second floor of the keeper's dwelling looking north, 1995. Note the floor register adjacent to the chimney, and the ghosted image of a former floor covering. The non-historic sink was installed in the 1950s.

Keeper's Dwelling - South Half of Structure

Following 1906, the south half of the structure housed the keeper and his family. Physical observation of the kitchen revealed the ghosted outline of a stove pad near the chimney, and evidence of a large rectangular piece of linoleum, which apparently covered most of the room's floor. The pantry still has many of its shelves intact. The uppermost shelf is different than the rest, suggesting it was added at a later date. The parlor and dining room both have had non-historic finishes applied to some of their surfaces, but overall they appear as they did in 1906. The stove pipe holes at the chimneys in both the kitchen and the parlor have metal covers, while the one in the dining room is not visible because the entire wall is covered with paneling.

There is no known physical or written evidence that heating stoves existed at the second floor. However, two holes in the floor system, which are covered with metal grilles, apparently acted as heat registers. The hole at the threshold of door 204.3 may date to the original structure, which, prior to 1906, was the ceiling of the dining room. A journal entry of 1904 indicates that the keeper, "cut a hole through the dining room ceiling to allow warm air to pass through to the upstairs sleeping chambers."² Physical investigation revealed an additional floor grille between the southeast bedroom floor and the keeper's kitchen ceiling just east of the chimney, as seen in Illustration 12. This grille opening most likely dates to 1931 when Keeper Wilks states in his journal, "...installed a register in the keeper's kitchen to allow heat to go upstairs."³

Assistant Keeper's Dwelling - North Half of Structure

The north half of the dwelling is a mirror image of the south half of the dwelling and was divided by floor into two separate residences. The first floor was the residence of the assistant keeper and his family while the second floor was the residence of the second assistant keeper and his family. Some historic documentation suggests, however, that the second assistant keeper and his family, if he had one, did not occupy the second floor for several years following the 1906 addition. This may be due to the fact that there was still only one bedroom at each floor level, and if the assistant had a large family they would not be able to fit comfortably in the space allotted.

The date of when the second floor began to be used as the second assistant's residence is unknown. A station

journal entry of 1913 suggests that the second assistant may have been living in the one-and-half story outbuilding, the warehouse, at the south end of the site stating that he, "...set a cookstove [sic] upstairs in the warehouse to do his cooking..."⁴ As late as 1916, journal entries suggest that the second assistant was still not living in the lighthouse itself, and was either occupying the one-and-one-half story warehouse or the one room "shack". One entry states that "the roof of the 2nd ass[istant's] shack [was] painted" and another soon after states that Second Assistant Keeper Cummins left his assignment after two days because there was no room for his family.⁵

A 1926 entry in the station's journal is the first known written documentation referring to the sink in the kitchen on the second floor of the north half of the building. This suggests that, by 1926, both the assistant and second assistant were living in the lighthouse. The exact date of their move into the dwelling is uncertain, however, since the sink may have been there all along, as evidenced by the fact that it appears in the 1905 drawings for the alterations of the dwelling. The living situation within the assistants' half of the lighthouse continued to vary throughout the history of the light station due to the familial situations of the keepers. There were several times when the first assistant keeper was a bachelor while the second assistant keeper had a family. In this situation, often the bachelor would live upstairs, allowing the lesser ranking second assistant and his family to live in the larger apartment. There is some written documentation of several periods in which this occurred.

It appears that the idea of allowing warm air to flow upstairs did not "catch on" with the assistant keepers, as there is no evidence of grilles in the north half of the building. There are, however, stovepipe holes at the chimneys on the second floor (which are currently covered with metal covers) indicating the existence of heating stoves in each room on the second floor. The main reason for this, most likely, was for privacy. Heat as well as noise could easily travel through the grilles, and thus, through the two separate residences.

Illustration 13



View looking south in the assistant keeper's kitchen, 1995. Note the cold water pipes that extend to the second floor sink, and the ghosted image on the wainscot of a former sink. The same ghosting image appears in the keeper's kitchen in the south half of the dwelling.

General Observations

Physical investigation revealed that pieces of linoleum or some other type of varnished canvas were used throughout the dwelling as floor coverings. Evidence of this appears as ghosted outlines around the perimeters of several rooms. The keepers continuously applied new floor finishes, as instructed by the Lighthouse Service, painting around the floor coverings or varnishing over them (Illustration 9). As can be seen in Keeper McLean's journal entries of 1909 through 1914, the light station was supplied with enough gallons of paint and varnish to keep them continuously busy. Maintenance was a daily routine, since the keepers always had to be prepared for inspections, which could take place at any time. The inspectors would arrive on the Lighthouse Service tenders, which continuously plied the lakes. The keeper never knew when one would stop and dock at Raspberry Island with an inspector aboard, thus the station (both inside and out) had to be meticulous at all times.

In both first floor kitchens, physical investigation revealed a ghosted image of darker paint and alteration of the wainscot around each of the kitchen sinks (which date to the 1940s), possibly suggesting the profile of the original sinks (Illustration 13). Cold water pipes, which are exposed and run through large holes cut into the floor and ceiling at the southeast corner of the assistant keeper's kitchen on the first floor, lead to the second assistant keeper's sink on the second floor (and later to the sink in the southeast bedroom on the second floor). There is no evidence of hot water service in the building. Three of the existing sinks are painted cast iron, the two kitchen sinks on the first floor and the second assistant keeper's kitchen sink on the second floor. The sink in the southeast bedroom on the second floor is porcelain and non-historic, and was installed by Ellerbee Architects during their use of the facility from 1958 until 1975.

1906 Tower

The tower that was constructed in 1906 protrudes from the east facade of the dwelling, and is more independent of the dwelling than the original tower was. It has its own winding wood staircase, and three separate entrances. It has a southern exterior door at the keeper's porch, and two interior doors, one of which leads to the stair hall of the north half of the dwelling at the first floor, and one that leads to the keeper's bedroom, located in the south half of the building at the second floor. The tower's staircase has two landings, and ends at the floor of the work room. A wooden ship's ladder then extends from the floor of the work room up to the floor of the lantern room (Illustration 14).

Historic documentation suggests that the lantern from the original tower, and all of the equipment it contained, were installed in the new tower as well.⁶ During the physical investigation, a slot in the wood floor of the lantern room was observed (Illustration 15). There is a corresponding opening in each floor level of the tower as well. The holes become slightly larger the closer they get to the ground. At the ground level there is a dark circular stain approximately 10" in diameter (Illustration 16). While all of the holes are currently covered with sheet metal, they originally comprised the weight shaft which enclosed the cords supporting the weight mechanism. The dark floor stain is most likely from oil which probably dripped night after night from the moving weights. The "flash panels, mounted on 'chariot wheels,' rotated slowly around the lens, their speed carefully governed by a clockwork mecha-

Illustration 14



View looking up the ship's ladder to the lantern room, from the workroom, 1995. Note the non-historic, unfinished baluster constructed below the handrail.

Illustration 15



View of the lantern room floor, 1995. Note the slot and frame in the floor adjacent to the lantern base. Originally, this was the shaft for the weight cords which operated the flash panels.

Illustration 16



Interior of the tower at the first floor level looking west, 1995. The arrow indicates the area of dark circular ghosting and broken floor boards at the center of the room, an indication of the former location of the weight shaft.

nism driven by a weight that descended in the ‘weight flue’ below the service room almost to the floor of the tower’s first level before it had to be wound up again.”⁷ The weight was rewound with a hand crank, an ongoing job performed by the keeper.

Occasionally, station journal entries state that the clock cord would break or slip off its pulley and crash to the floor. The floor boards directly below the “weight shaft” openings are indented and splitting, suggesting that, indeed, the weights were dropped several times.

The “Detailed Description of Premises” states that the characteristic of the light was “Fx.[sic] white varied by a white flash every minute,” and that it “Revolve[d] once in 3 minutes.”⁸ Thus, one entire rotation of the flash panels along their path on the perimeter of the pedestal created a flash of light every minute. Illustration 17 shows the original Fresnel lens with the flash panels enclosing it.

Historic documentation, including keepers’ journal entries describing maintenance work, and the 1910 “Detailed Description of Premises,” suggests that from 1888 on, the

Illustration 17

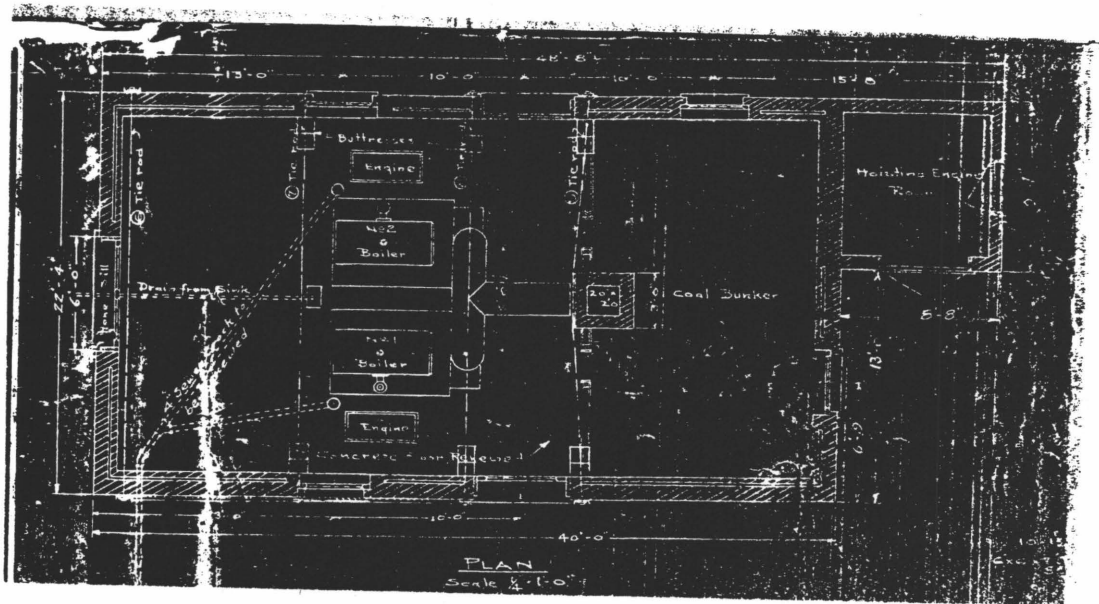


View of the original fifth order Fresnel lens with flash panels, as displayed in the State Historical Society of Wisconsin's Madeline Island Historical Museum.

exterior of the lantern was painted black. Documentation prior to 1888, however, reveals that the lantern was painted white. An interesting finding of the paint analysis of a paint sample taken from the lantern, revealed at least two layers of paint that were neither white nor black. One layer is a silver color and the other is a gold, with a layer of white paint in between them. The paint analysis also suggests that the original layer of paint was dark gray. These color variations are assumed to have lasted only a short time, and were quickly changed back to the standard black (which is the color that it is today).

The room directly below the lantern is the work or service room. The room has two windows, one each on the north and south walls. Both have double-hung wood sashes (metal bars are currently attached to the inside frames for visitor safety). The wood trim, with decorative corner blocks, is identical to that found in the dwelling portion of the lighthouse. The “Detailed Description of the Premises” of 1910 states that the “service room is equipped with a shelf holding spare lamps and oil tanks.”⁹ Physical investigation did not reveal any evidence of the supposed former shelf, however, the ghosted outline of a shelf and

Illustration 18



1925 floor plan of the Fog Signal Building entitled, "Raspberry Island Light Station Wis., Fog Signal Building Repairs." Note that the metal tie rods (with their exterior attachment) appear on this drawing.

bracket exists on the wainscot in the lantern room above. The *Historic Furnishings Study* states that physical evidence indicates that the southwest corner of this room once was occupied by a table or cabinet 42" long and 18" deep, and probably had shelves above to hold the equipment and supplies needed for cleaning the glass, brass, and steel of the lens, etc.

Related Outbuildings

Fog Signal Building

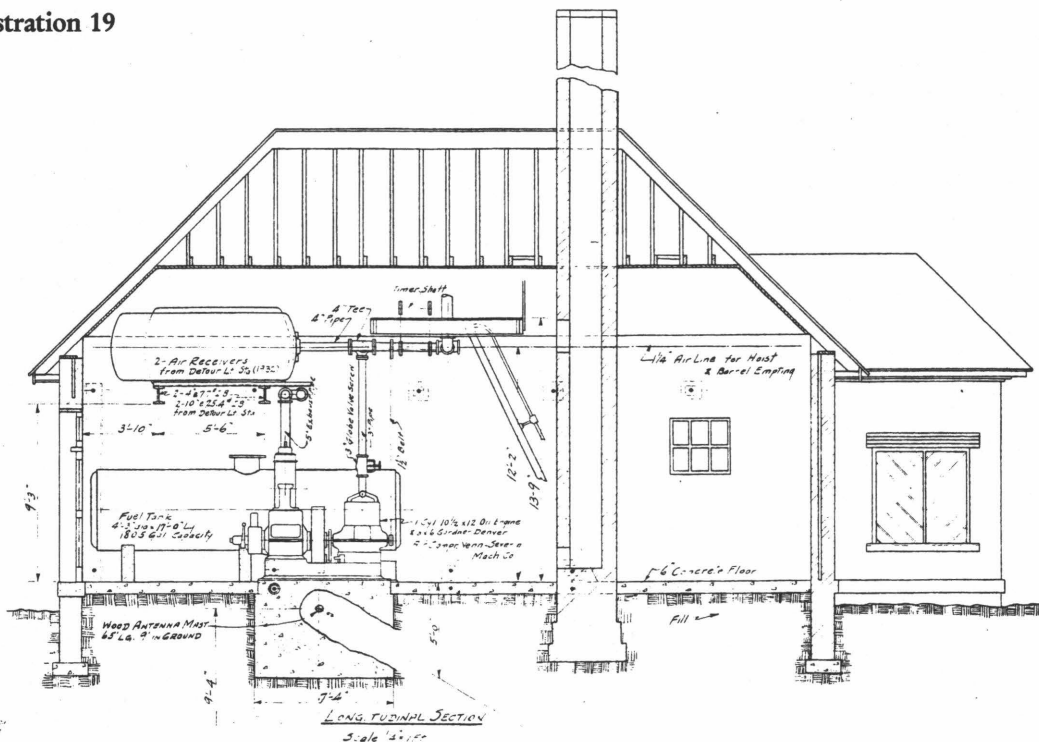
The fog signal building was constructed in 1903. Its walls are brick and are 15" thick. Illustration 17 indicates that the walls have the same construction detail as the walls of the lighthouse, consisting of two outer brick wythes and one inner wythe with a 3" air space between the inner and outer wythes. The brick is laid in common bond with six courses of stretchers for every course of headers. Physical investigation revealed that the floor is a concrete slab, and a historic drawing of 1925 (Illustration 18), states, "concrete floor renewed". The "Detailed Description of Premises" of 1910 states that the building is supported on a brick foundation. All of the window openings have brick arched headers, a detail common to brick fog signal buildings of the Great Lakes.

Originally, the south half of the fog signal building was partitioned off with wood framing at the chimney, and served as a "coal bunker," see Illustration 18. Historic documentation suggests that both wood and coal were stored there. The two identical boilers, which consumed the coal and ran the 10" steam whistles, were located in approximately the center of the space north of the chimney, as shown in Illustration 18. Illustration 18 and 20 indicate, and physical investigation revealed, four concrete "buttresses" along both the east and west walls at the third points of each wall.

The hoist room was constructed at the far south end of the building as a separate, yet attached, structure. While a common wall and roof are shared, no opening exists between this room and the fog signal building. The winch that hoisted the tram up the tramway was located within this room, which had a large opening on the west elevation. The winch room and tram are still extant, and a new electrically powered winch has been installed by the National Park Service.

In 1932, the fog signal was changed from a steam and whistle system to an air diaphone system, which was run by "semi-diesel engines" and air compressors. Most of

Illustration 19



Longitudinal section of the fog signal building showing the installation of the air diaphone, 1932.

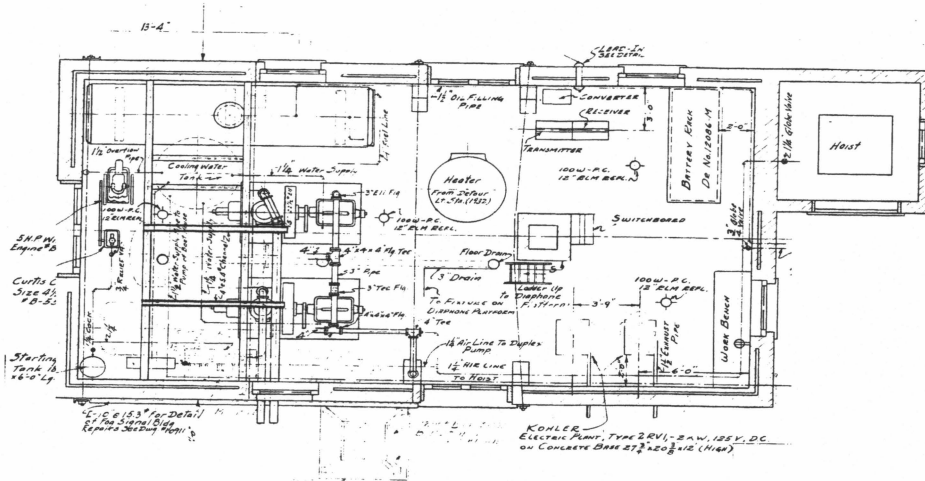
the new equipment occupied the same area in the north half of the building that the previous steam boilers and engines had (Illustration 18). The partition wall was removed and the previous coal storage area became a work space. A large platform was suspended from the ceiling at the center of the room along the west wall of the building, which held the diaphone apparatus. A large dormer was constructed above the platform to provide the additional height required and to support the air horns. One horn protruded through the north elevation and one through the south. A ladder to the dormer platform is located just west of the chimney. The station journal states that the handrail around the perimeter of the platform was installed in 1937.¹⁰ The dormer has two windows on the west elevation, both with four over four double-hung wood sashes. (The air diaphone equipment has since been removed from the building, and the openings in the dormer where the horns were located are currently covered over with sheet metal.)

By 1925, the age and condition of the building necessitated the structural modifications. The structural reinforcement, as revealed during physical investigation and examination of historic drawings, consisted of the installation of

nine metal tie rods (five of them approximately 9'-0" above the floor and four of them embedded in the concrete floor) spanning the interior in an east-west direction spaced approximately 8' - 9" apart. The rods run through the exterior masonry wall and are secured at the exterior face with steel plates. Along the west elevation the steel plates are all connected with an exterior steel channel along the wall's face. Historic documentation, such as that found in the book entitled, *Metals in America's Historic Buildings*, states that, "Wrought-iron tie rods were added to buildings to prevent walls from buckling or separating from interior walls. The rods were bolted to cross beams or to a parallel masonry wall. They were always made of wrought iron to take tension. To prevent horizontal forces from pulling the tie rods through the wall, they were connected to cast-iron stars, rosettes, or "S" anchors on the outside of the wall."¹¹ The exterior anchors at this structure were simple rectangular steel plates, which were necessary as there were no interior walls in the fog signal building.

The main fuel tank that supplied the air diaphone system was approximately 12'- 0" long and was located in the northeast corner of the building on three concrete saddles. These concrete saddles are still extant. They are painted

Illustration 20



Floor plan of the fog signal building showing the installation of the air diaphone, 1932. This drawing was revised in 1939, 1941, 1946, and 1947.

gray and have deteriorated, with large portions of the concrete missing from the top of each.

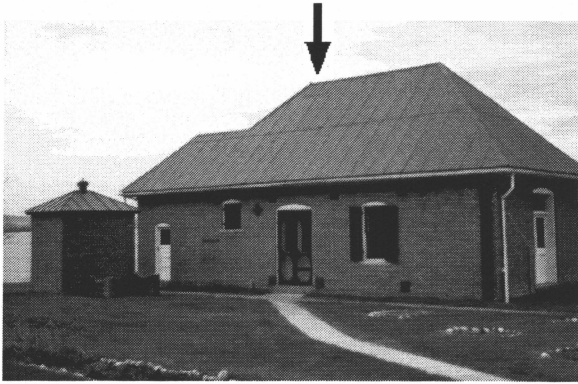
Equipment needed to electrify the station was installed in the fog signal building in 1941. The main reason for this upgrade was to power the radiophone, which was also installed at this time. Both the lighthouse and fog signal building were wired for electricity, and equipped throughout with light fixtures. Due to the automation of several other light stations in the region, there was a surplus of Kohler generators not in use. One was brought to the island and installed in the fog signal building to generate electricity.

A battery bank and replacement Kohler diesel-operated generators were installed in 1946. Since the chimney was no longer required, a portion above the roof was removed sometime prior to 1947. Its removal was probably due to a combination of deterioration and water leakage into the building. The roof opening has been patched with corrugated metal to match the adjacent roof surface, which can be seen in Illustration 18.

A CO₂ automated bell striker was installed in 1947, and added to a fog signal drawing of 1932. The bell was struck every 15 seconds, eliminating the need for manual operation and maintenance. The drawing indicates that the bell striker was located on a 6" concrete base, 5'-0" square, along the west elevation of the building just north of the double-leaf door opening. Physical investigation revealed that the concrete slab is extant, partially covered with growth.

The Coast Guard "discontinued the Raspberry Island fog signal in 1952 and subsequently removed the generators, air compressors, and diaphone horns."¹² A 1944 Kohler generator, although not original, remains in the southwest corner of the building and a second generator, installed by the National Park Service much later, is located just north of it.

Illustration 21



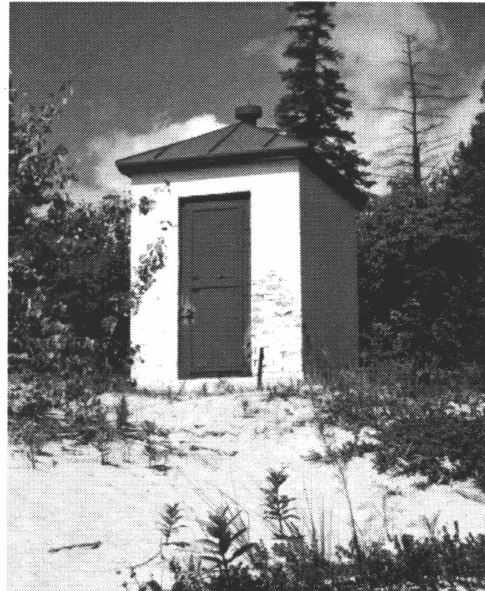
View looking southwest of the fog signal building and brick oil house, 1995. Note the patch in the fog signal building's corrugated metal roof at the former chimney opening.

Brick Oil House

By 1877, the U.S. Lighthouse Service had begun to convert the primary fuel at light stations across the country to kerosene because it provided better illumination than the previous fuel standard, lard oil. In 1880, this change reached Raspberry Island and, by 1885, kerosene was the principal fuel used to illuminate lights nationwide. The transition, from lard oil to the much more flammable kerosene, led to the need for safer storage areas. Formerly the lard oil was stored in the cellar of the keeper's dwelling, as was typical of most light stations. The high level of flammability of kerosene, however, made it very unsafe to store in the basement. Thus, brick oil houses, independent of the dwellings, were constructed at light stations around the region. The oil house at Raspberry Island was not, however, constructed until 1901.¹³ This leaves a period of twenty-one years in which the flammable fuel was used, but not stored in an alternate location. Journal entries of 1900 state that shelves were built in the basement of the lighthouse for storing the oil.¹⁴ No documentation exists that indicates how the oil was stored prior to the construction of these shelves, however.

With the tremendous and rapidly growing need for brick oil houses around the Great Lakes, a standard design for their construction was developed. As a result, many of the oil houses in the region share similar characteristics. However, as was common, the basic standard design was often modified, allowing for slight variations, usually in the materials. Typically, the bottom few brick courses pro-

Illustration 22



Brick Oil House, South Manitou Island Light Station, Lake Michigan, 1994.

truding creating a plinth around the perimeter of the structure. They also had metal doors with stone or concrete sills and floors, and a metal roof with a roof ventilator as seen in Illustrations 22, 23, and 24. Lighthouse Service crews travelled to the various stations, constructing the storage buildings within a period of a few days.

The Raspberry Island oil house is constructed of red brick laid in stretcher bond courses with a standing seam metal hip roof, and a circular metal vent at the center ridge allowing the highly flammable fumes of the fuel to escape. The west elevation has a riveted metal door with a stone lintel and sill. The floor has been painted gray. The exterior metal and trim surfaces are painted red, a typical color for metal and wood trim on these structures.

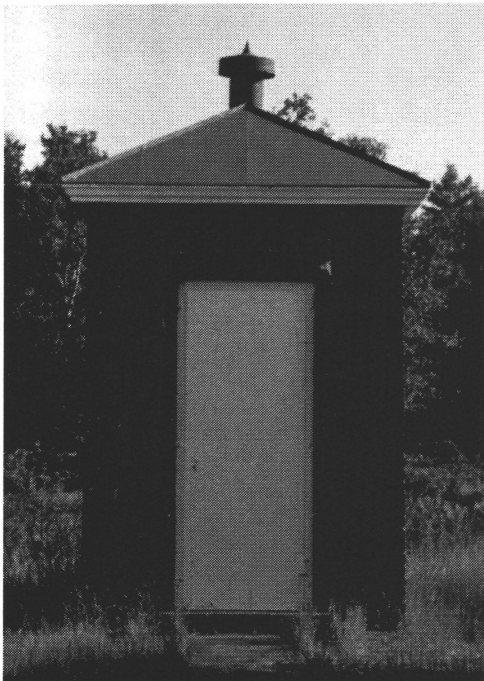
In addition, there are two concrete saddles on both the north and south side of the brick oil house. The tanks they once supported are no longer extant. They may have held the fuel that generated the diesel-powered engines of the air diaphone fog signal. Illustration 19b shows the large concrete saddles just north of the brick oil house.

Illustration 23



Brick Oil House, Raspberry Island Light Station, Lake Superior, 1995. Note the concrete saddles..

Illustration 24



Brick Oil House, Au Sable Light Station, Lake Superior, 1995.

Two Privies

The station has two privies, one directly east of the southern half of the lighthouse, connected via a concrete walk. This privy was used by the keeper and his family. Presumably the second, larger privy was constructed in 1906. It is

northeast of the lighthouse, and was used by both the assistant and second assistant keepers and their families. Both extant privies are of wood frame construction with clapboard siding and wood trim similar to the lighthouse itself. The roofs are currently covered with rolled asphalt, which was installed by the National Park Service in 1977. Park records suggest that these roofing materials were installed directly over the original metal shingles. The small, original privy began sinking at some point. To mitigate this problem, a concrete slab foundation was constructed, which is what the privy rests on currently. The cleanout is gone. Since there is no evidence that either privy was rebuilt, it is likely that they are both the original construction in their original locations, albeit with minor upgrades and maintenance changes.

“Warehouse”

The one-and-one-half story building, located at the southeast corner of the site, historically has been referred to as the “warehouse”. There are also some references to a “barn,” which is assumed to be this structure as well. The building was renovated into living quarters for Ellerbee Architects’ on-site caretakers, and later served as the on-site residence for National Park Service staff, hence the current name “Ranger’s Residence.”

The interior of the building is approximately 15’ x 23’-6”. The first floor has one large kitchen/living space, a small bedroom, and a staircase to the attic. Several of the interior finishes are assumed to date to the late 1950s when Ellerbee Architects had a presence at the site, including the drywall of the ceiling and walls, the sheet vinyl flooring, and the ca. 1950s kitchen cabinets all at the first floor. The National Park Service later installed two refrigerators, a stove/oven, and a heater all fueled by propane.

The only wall surface not covered with drywall is the inside stair face of the stair wall leading to the attic. It is 5/8” vertical beaded board. This may suggest that interior finishes were applied to the structure prior to the 1950s.

The attic space is approximately 59” high. Collar ties connect each set of rafters, and are approximately 8’ above the attic floor. The floor is unfinished wood planks.

Illustration 25

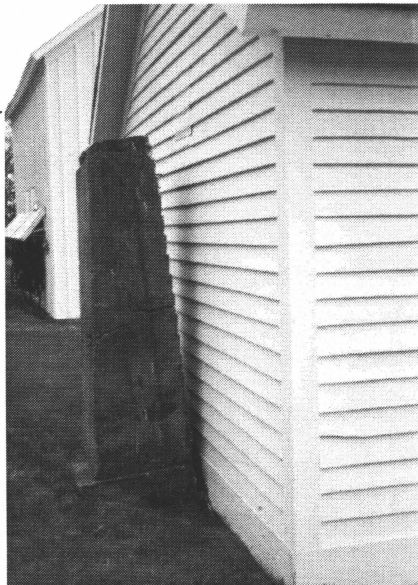


Interior view of one of the windows in the "Shack," 1995.

"Shack"

The one room structure just north of the one-and-a-half story warehouse has been referred to in historic documents as the "shack" or "cabin." This structure has clapboard siding and a five-panel wood door. The interior finish trim is characteristic of the 1860s, suggesting that this structure served some type of domestic purpose from early on in the history of the station. Several assumptions have been made as to who

Illustration 26



View of the concrete chimney constructed alongside the rear (east) wall of the "shack," 1995. Note that due to excessive settlement, the chimney has pulled away from the wall surface.

occupied this structure including: the Lighthouse Service crews who visited and worked at the island, and the second assistant keeper, prior to the installation of his kitchen in the dwelling. It has also been speculated that it was used as a summer kitchen. The 1860s period trim does not appear anywhere else at the site, suggesting that it may be material leftover from another station dropped off by one of the lighthouse tenders, or else salvaged from the 1863 lighthouse. The walls are covered with random width, beaded tongue-and-groove wood boards. Both windows were originally casement windows, but were converted to sliders, probably during the renovation work done in the 1960s.

In addition, there is a poured concrete chimney along the east elevation of the building (Illustration 26). The former opening for the stovepipe connection is currently covered over with painted sheet metal. The historic ceiling was not visible during physical investigation, because it is currently covered with 8" x 8" acoustic ceiling tile, which appears to be directly adhered to the historic surface. The floor is also covered with non-historic sheet vinyl. In the early 1960s, on-site caretakers hired by Ellerbee Architects renovated this one-room structure as a residence for the gardener. This "Gardener's Residence" was updated and continued to be occupied by National Park Service personnel until shortly before physical investigation when it was vacated due to non-compliance with current residential safety codes.

Wood Shed

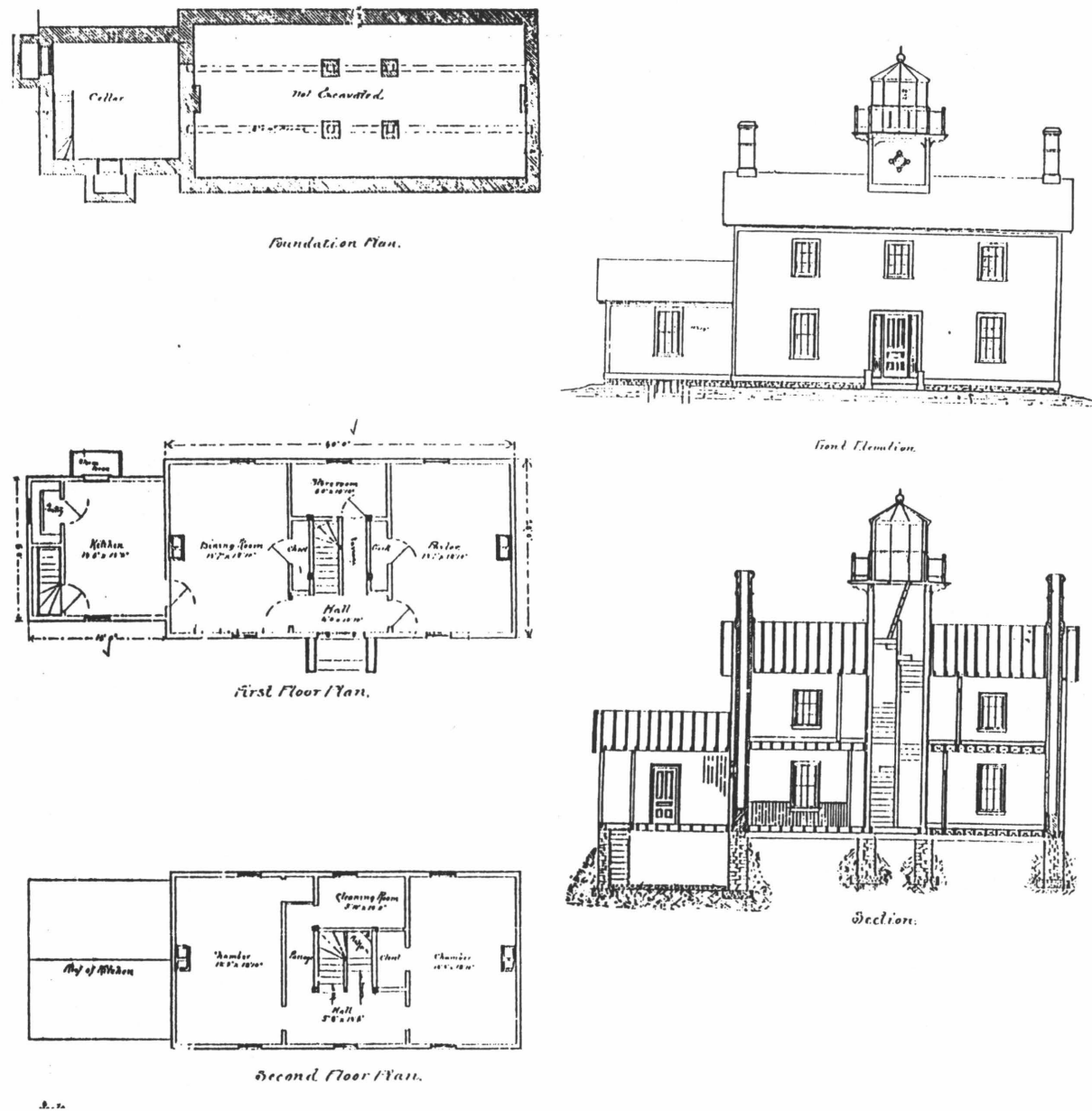
The exterior of the wood shed, which is located directly east of the lighthouse, is wood board and batten siding painted white. The door has a 5-panel configuration similar to the door at the one-room "shack". This type of door is quite elaborate for a wood shed, suggesting it may have been salvaged, along with the one at the shack, from the original 1863 lighthouse.

The interior walls of the wood shed are the exposed backs of the exterior boards, and the floor is an unfinished floor of 2" x 12" planks running north-south. There is a wood loft in the space, which is approximately 8'-0" above the main floor, with a ladder constructed along the interior of the west wall for access.

Part E:

Building and Site Chronology

Illustration 1



Drawings, indicated "as built" of original lighthouse. Structure remained relatively unchanged until 1906.

Part E: Building and Site Chronology

History of Alterations and Additions

Physical investigation has revealed that most of the extant lighthouse materials date to the construction period of 1906, however, a small amount of the materials observed date to earlier construction phases. The year 1906 is pivotal in the history of the lighthouse in that it marked the largest major physical change of the structure since its initial construction. This change included a substantial addition to the dwelling and the reconstruction and relocation of the light tower.

Analysis of Building Episodes

Episode I: 1862 - 1905

Aside from minor interior alterations that were undertaken as part of the routine maintenance and upgrading of the station, the original massing of the lighthouse remained largely unaltered until 1906. Further, there are no known extant historic photographs of the interior of the original lighthouse. All information regarding the interior has been gathered from historic drawings (Illustration 1), and from written documentation, including the journal entries of various keepers who worked at the station, and correspondence written by district engineers and inspectors who visited the island. Most of the documentation is brief, and typically contains only vague descriptions of normal duties such as cleaning and painting. For example, in August of 1863, the interior is described as having received, "two coats of white lead in oil throughout," suggesting that the entire interior was painted white.² Often keepers were sent specific supplies with accompanying instructions to keep the station fresh, clean, and in a state of readiness, as was required by the Lighthouse Board. One keeper states in his journal that he, "repainted [the] outside of [the] tower and dwelling house this summer according to directions received..."³

All elements of the lighthouse exterior were originally painted white. Several journal entries, including that of July 20, 1888, indicate that the color of the structure's exterior was changed from entirely white to: white for the walls; "lead" [gray] for the wood trim; and, black for the lantern. This color scheme can be seen in Illustration 2 which is dated 1903 - 1905. It appears that this color scheme was maintained until the construction alterations of 1906, at which time the exterior was once again painted entirely white, with the exception of the lantern which remained black.

The U.S. Lighthouse Service continuously sent work crews to light stations throughout the Great Lakes to construct new structures, and to make repairs or alterations to existing ones. During the 1901 season, a crew visited Raspberry Island and replaced the dwelling's roof with stamped metal shingles. No written documentation of the former roofing material exists, but in historic photographs, such as Illustration 3, the roof surface appears to be coarse, suggesting that the original shingles may have been wood. Their coarse and irregular appearance could be attributed to the frequent harsh weather conditions to which they were exposed. The replacement choice of stamped sheet metal shingles was probably deliberate. Not only were they popular for residential construction during the early 20th century, but they were also considerably more durable than wood.

Another significant non-extant feature of the original lighthouse, as indicated on the historic drawings (Illustration 1) was the cellar. The original cellar existed only beneath the one-story kitchen wing, (the space beneath the main structure was initially unexcavated). The cellar had a window along the north elevation, with an areaway to admit fresh air and light into the space, and an exterior cistern or collecting well along the west elevation. The original cellar floor, as was consistent with the period, was probably dirt or clay, or, at most, had a thin layer of rough concrete. Station journals of 1901 indicate that, during a six-week

Illustration 2



View of the Raspberry Island Lighthouse, ca. 1903-1905, looking southeast.

Illustration 3



View of the Raspberry Island Lighthouse, ca. 1900-1901. Note the central light tower with one decorative balustrade and diamond-shaped window.

period, work crews “poured a new cellar floor” and “installed a storm sewer.”¹ These projects were undertaken because of the continuous flooding of the basement, and are the first indication of any manipulation of water drainage on the site.

One other unique feature of the original lighthouse, that no longer exists, is the interior wall finishes. They were unique in that they were not plastered. This was highly unusual considering the extreme climate of the area. The district engineer’s report of October 9, 1868 states that “the walls of this Light House, which is built of wood, are covered with boards on the inside instead of plastered. These boards have shrunk very much so as to admit the air from the outside. The building is in consequence very cold in winter. I recommend that the house be plastered throughout.”⁴ The recommendation was acted upon, however, the exact date is unknown. Journal entries of 1897 discuss the replastering of the dining room, suggesting that the walls had at least been plastered for some time prior to this date.

The original 1863 tower rose from the center of the two story dwelling. It was square in plan and approximately the same size as the existing tower. The only window opening observed in historic photographs is a small diamond shaped window on the west facade, as shown in

Illustration 3. It was accessible via a wooden staircase that ran in an east-west direction, and provided access not only to the lantern, but also to the first and second floors of the dwelling (Illustration 1). The lantern originally exhibited a fixed white light, but was soon equipped with flash panels and related equipment that continued to be used throughout the duration of the operation of the lighthouse. “They [the flash panels] were apparently installed by the spring of 1868 because Capt. A.L. Case, Third District Inspector, Tompkinsville, New York sent instructions relative to a white flashing apparatus for Raspberry Island to Eleventh District Inspector Stevens.”⁵ This equipment required ongoing and extensive maintenance. The keeper’s journal entry of July 25, 1872 states that the “lamps and revolving machinery were overhauled and repaired...”⁶ It is unknown exactly where in the stairwell the weight shaft and clockwork apparatus needed to operate the flash panels were located. It is speculated that they were either located within the hollow shaft of the wood frame wall in the center of the stairwell, or in a shaft located in the southeast corner of the stairwell.

In 1866 an assistant keeper’s position was established, but it was soon abolished in 1868. Keepers repeatedly lamented that the work of maintaining the light throughout the entire night required additional assistance. The position was finally re-established in 1892. There is little documentation regarding the assistant keepers who were stationed at Raspberry Island during the 1890s. However, it may be assumed that they occupied one of the outbuildings as their residence, and many probably did not either have or bring their families with them to the island.

A fog signal building was constructed in 1903, adding many new responsibilities to the operation of the light station. Originally the station required only one keeper for its operation and maintenance, and the attached dwelling served as the keeper’s family’s residence. When the keeper needed additional assistance to operate the station, he would call upon one of his family members, usually his eldest son or his wife. This situation was ideal, since the family was already living on the island and probably had plenty of time on their hands.

Episode II: 1906 - 1939

Following the construction of the fog signal building, one keeper, with the aid of one assistant, could not successfully fulfill all of the new responsibilities the fog signal added to the station. Additional skilled men were required to operate and maintain the steam engines and machinery that ran the steam whistles. These men, however, were in short supply in the Great Lakes region. This created a sense of urgency, as evidenced through letters written by the district engineer concerning problems at other stations with fog signals. He says that "the station is in imminent danger where men who understand nothing about a boiler are in charge of a steam signal. At this moment three out of the five steam fog signals are out of order on account of the ignorance of their keepers."⁷ Fog and smoke from nearby forest fires would sometimes last for days, making round-the-clock operation of the fog signal by knowledgeable individuals critical. With the isolated location of Raspberry Island, the problem arose, as at many other stations, of not being able to find qualified men who would live on the island and perform this work without bringing their families with them. The decision was made that additional housing at the station was needed. In 1906, an addition and several alterations were made to the dwelling to accommodate an assistant keeper and a second assistant keeper, and their families.

While a new structure was added onto the existing building, the original central division of space was kept intact. The 1905 drawings indicate that the building was to be a triplex. The keeper and his family were to occupy the entire south half of the building, while the assistant keeper and his family were to occupy the north half of the first floor, and the second assistant keeper and his family were to occupy the north half of the second floor. Each were to have their own private entrances. As indicated in Part D, however, the building served as a duplex for several years following the 1906 construction, and journal entries, as late as 1916, suggest that the second assistant keeper was still occupying an outbuilding.

A new tower was also constructed in 1906, which was 8'-6" square in plan. The lantern from the 1862 tower was removed and placed on top of the new tower. All of the equipment related to the light, including the flash panels, clockwork, etc., was also transferred to the new tower. Ventilation holes were cut through the wainscot to the exterior around the perimeter of the lantern room, and

ventilator caps were installed which could be manually opened and closed to regulate air flow in the room. By 1932, the original ventilator caps must have either deteriorated or were, for some unknown reason, removed. During one of the trips that the keepers took to check on the then recently automated Sand Island Lighthouse they brought back brass ventilator caps (they often brought back "souvenirs" on their trips), and installed them in the tower at Raspberry Island. The reasoning behind this is unclear. It is possible that these replacement caps were in much better condition than those at Raspberry Island. By the 1970s the replacement caps had disappeared. The caps that are on the tower today were donated to and installed by the National Park Service.

One of the keepers stationed at Raspberry Island during this episode made several valuable contributions, through his handiwork, to the station. Keeper Louis J. Wilks was stationed on the island from 1928-1933. He built kitchen cabinets in both the keeper's and the second assistant's quarters, and installed a register in the ceiling of the keeper's kitchen to allow warm air to flow upstairs. He also, "fabricated screens for the front porches, replaced the porch posts and installed a metal top on the sink in the first assistant's quarters."⁸ The screens completely enclosed each of the porches, as seen in Illustration 4. Many of these alterations were simply "part of the job," and several of the other keepers probably contributed significantly to the light station as well, but there is little or no documentation of their work. It is known that, from early on, the keepers did contribute their skills. By the end of the first season of the new structure, for example, the keeper had built and installed screens for all of the windows of the new lighthouse.

Illustration 4



View of the lighthouse ca. 1930-1940 with the porch screens installed.

Episode III: 1940 - 1957

In 1939, the U.S. Lighthouse Service was absorbed into the United States Coast Guard. This change appears to have had minimal physical impact on Raspberry Island. No documentation was found describing either changes in the status of the employees, or in the physical characteristics of the site.

Shortly after the Coast Guard acquired ownership, electricity was introduced to the island. In 1941, the entire keeper's dwelling and the light tower were wired for electricity. There is no actual evidence, but through observation it seems that the duties of the keepers were greatly lessened with the introduction of electricity. No longer did the light's wick need to be trimmed, the kerosene filled, or many of the other time consuming jobs performed. Other changes that occurred at the station that year as well included: the installation of diesel generators and storage batteries in the fog signal building to generate and store the electricity for the lighthouse and the air diaphone fog signal system, and the installation of a radiophone, which allowed the keeper to communicate with other lighthouses and Coast Guard stations.

In 1947, the Coast Guard officially "unmanned" the light through automation, and appears to have relatively abandoned the station in its existing condition.⁹ The air diaphone system had already been removed the year before, and replaced with an automatic CO2 bell striker that was installed along the exterior of the west elevation of the fog signal building. In 1947, the flash panels were removed from the lantern room of the tower, and replaced with a battery-operated electronic flashing unit. Later, when navigational aids improved and became more commonly used such as radar, the intensity of the light required was lessened. Eventually, the Fresnel lens was removed and replaced with a small acrylic lens placed atop a small steel pole at the edge of the bluff just west of the fog signal building. Once these changes took place, only a few maintenance checks were required for the operation of the station each season. The checks were likely done in one day by Coast Guard personnel from the Bayfield station.

Episode IV: 1958-1974

The efficiency and low maintenance of the technological equipment which ran the new light required few, if any, visits to the island by the Coast Guard. As a result, the site became a lesser priority of the Coast Guard, and continued to remain abandoned. In 1958, the lighthouse was leased to Ellerbee Architects, a Minneapolis-based architecture firm, for use as their corporate retreat. According to David Snyder, "the Coast Guard apparently allowed the company to maintain and remodel the lighthouse as part of their lease."¹⁰ The lessee hired on-site caretakers for Raspberry Island, who converted two of the outbuildings into residences and lived in them. The conversion does not appear to have harmed the exterior historic fabric of the structures.

The caretakers also did work in the keepers' dwelling. They apparently applied several non-historic finishes to the interior (many directly to the historic plaster) of the main dwelling, such as paneling to the walls and tiling to the ceiling of Apartment A's (the original keeper's quarters) dining room. They also: installed new linoleum in both Apartments A and C (the assistant keepers' quarters); installed a gas refrigerator in Apartment C's kitchen; and, painted the metal roof.¹¹ Because of these modifications, some of the interior historic fabric was damaged.

Sometime before 1975, the Bureau of Land Management took possession of Raspberry Island. There is no documentation of when this change took place, or whether it had any effect on the 15 year lease to Ellerbee Architects. In 1975, the National Park Service acquired Raspberry Island from the Bureau of Land Management.

Episode V: 1975 - Present

In 1975 the light station was transferred from the Bureau of Land Management to the Apostle Islands National Lakeshore, a unit of the National Park Service, established in 1970. The National Park Service was quick to realize the cultural and historical importance of the light station, and soon nominated it for placement on the National Register of Historic Places, along with four other light stations within the Lakeshore (the La Pointe Light on Long Island was the only exception since Long Island was not added to the lakeshore until 1986). All were deemed eligible and placed on the Register.

In the late 1970s, the National Park Service began to stabilize the structures at the Raspberry Island Light Station. The Lakeshore's files contain maintenance records of all of the work carried out during this period, which consisted primarily of basic stabilization efforts and continued overall maintenance.

The most extensive work undertaken by the National Park Service was in 1977 with the stabilization of the foundation of the lighthouse itself. This work included: the construction of a concrete block retaining wall along the entire east foundation wall of the lighthouse; the application of masonry waterproofing; additional drainage lines and rerouting of the drainage system; and, the tuckpointing of several areas at the interior face of the basement walls and at the exterior face of the foundation walls above grade. The areas of tuckpointing are highly visible due to the incompatibility of the new mortar color with the historic mortar color.

In 1982, significant window repairs were undertaken by the Park Service. This work appears to have included the stripping, refinishing, and reglazing of the windows, and, in some cases, replacement of the wood sashes. In 1987, not only were the windows reglazed again, but the steps and porches of the two east (rear) entrances to the lighthouse were reconstructed. They are virtually identical to their historic counterparts, with a few exceptions. For example, holes have been drilled into the wood decking and treads to allow ventilation beneath the stairs and help prevent rot.

A building inspection form dated August 7, 1975 stated that the lighthouse had asbestos-type shingles. Using that evidence, Snyder reported that the "asbestos-type roof shingles were removed [from the lighthouse] and the original metal shingles exposed and painted."¹² If this was the case, the asbestos-type roofing would have been installed after 1966 because documentation exists from Ellerbee Architects that says that they painted the metal roof that year. Additionally, there is no physical evidence, such as holes from fasteners or remnants of a cohesive material, to suggest the presence of this non-historic roofing material. Furthermore, a photo from 1974 (Illustration 5), just prior to the National Park Service's ownership, shows that the metal roof shingles are exposed. This suggests that the asphalt roofing would have had to have been applied after 1974 by the National Park Service, however, there is no physical evidence that the original roof was ever actually covered over.

Illustration 5



View of an abandoned Raspberry Island Lighthouse in 1974, prior to the National Park Service's ownership.

Conclusion

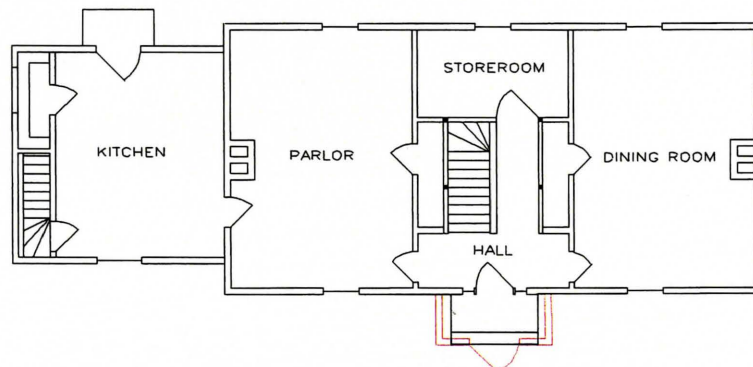
Raspberry Island Light Station has undergone five primary episodic changes throughout its 133 year life span. However, it is important to remember that the utilitarian function of the station kept actual physical changes to a minimum. Alterations were generally undertaken only when new technology became available, or when additional people were needed to operate the facility, creating a need for such things as additional housing and privies on the site.

The light station existed to protect the lives of the people and the goods traveling on the often turbulent Lake Superior. The most efficient means of achieving the work at hand was always sought. Episode II, spanning 1906 - 1939, is the only time period in which the lighthouse itself underwent extensive physical changes. The other episodes represent significant periods of change, but only in the sense of ownership and technological upgrades.

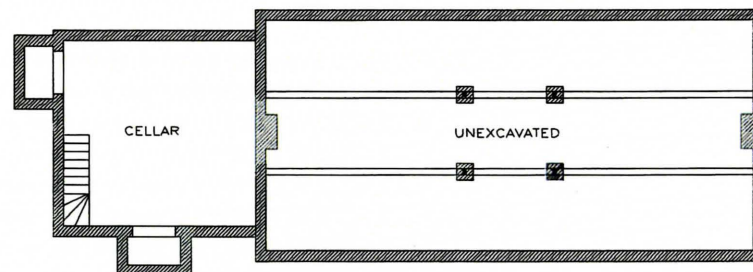
Episode I: 1862 - 1905



Second Floor

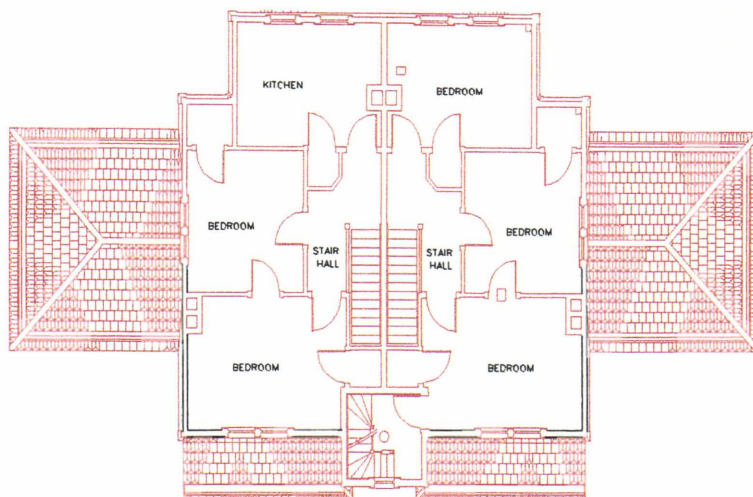


First Floor

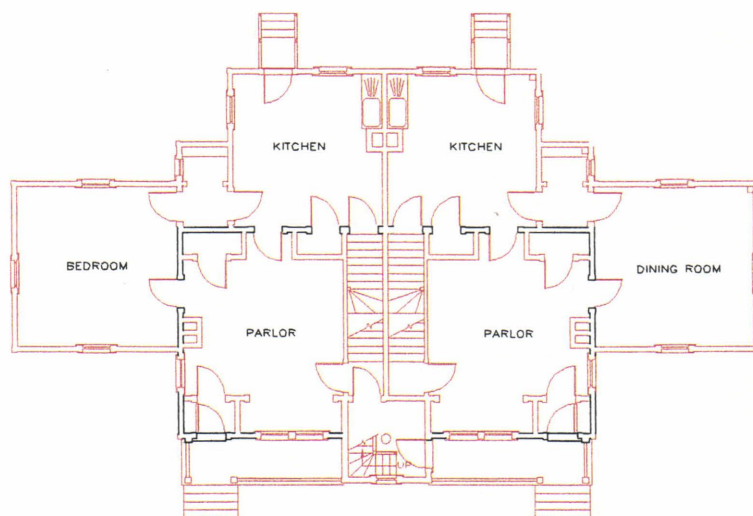


Foundation

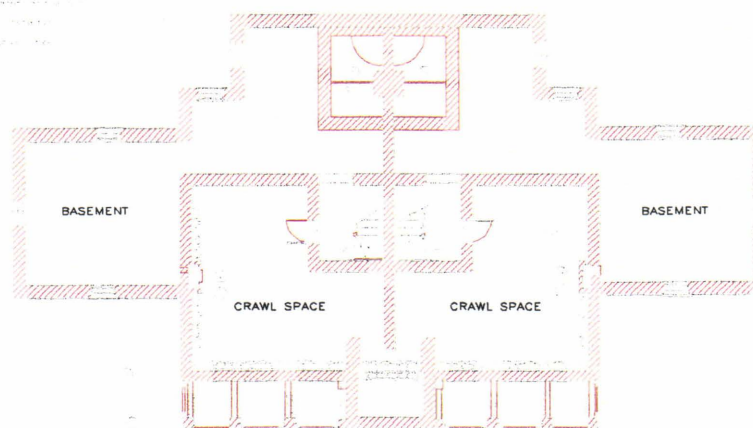
Episode II: 1906 - 1939



Second Floor

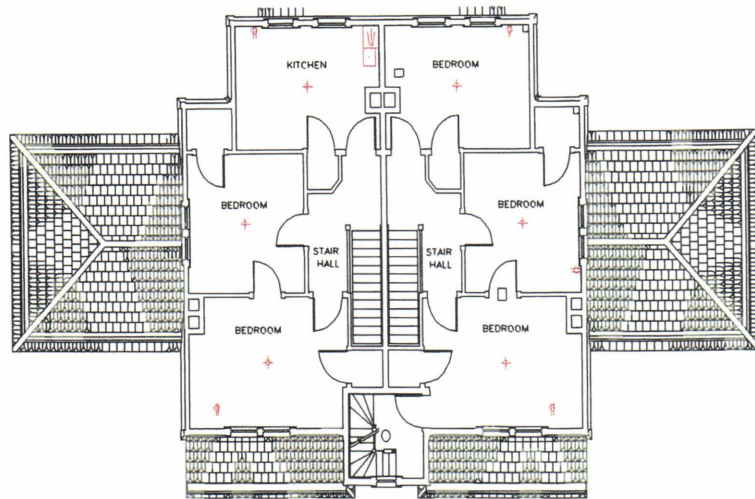


First Floor

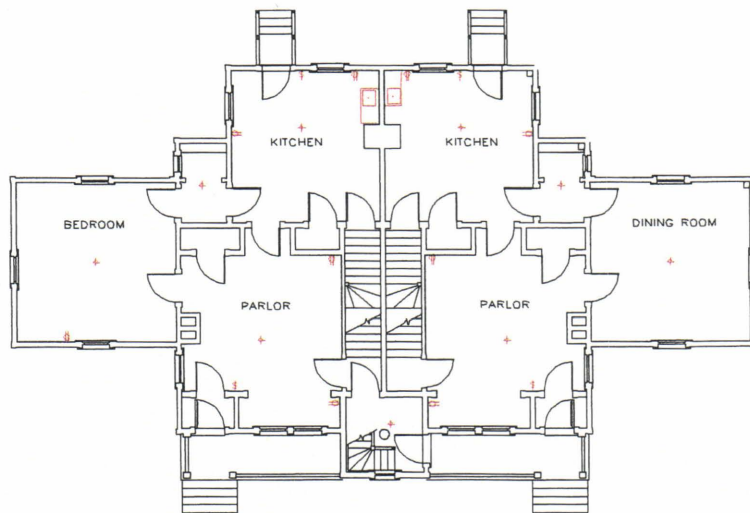


Foundation

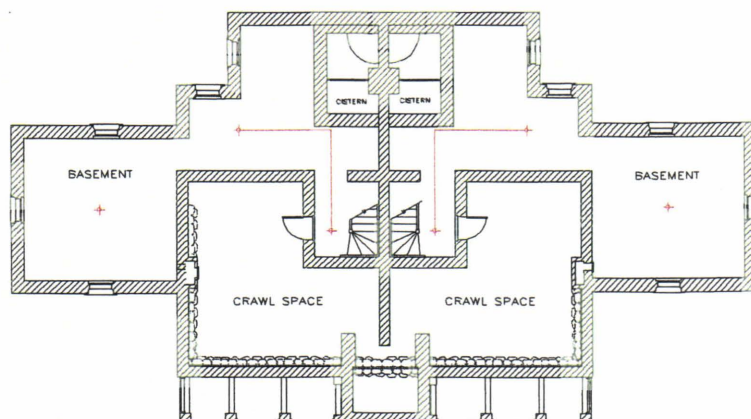
Episode III: 1940 - 1957



Second Floor

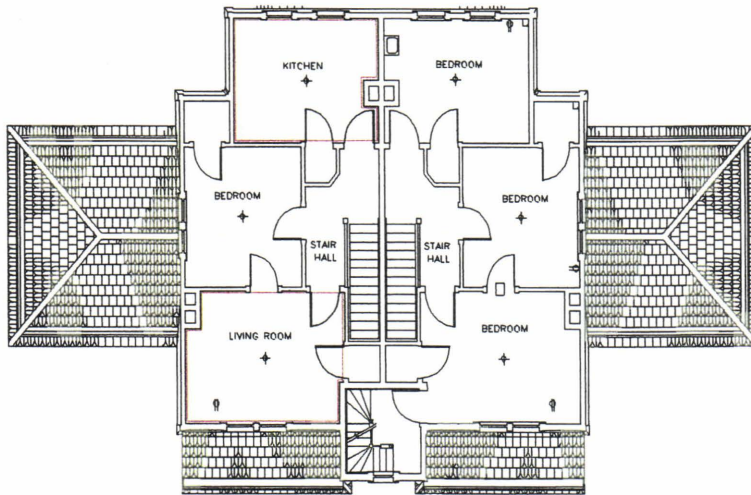


First Floor

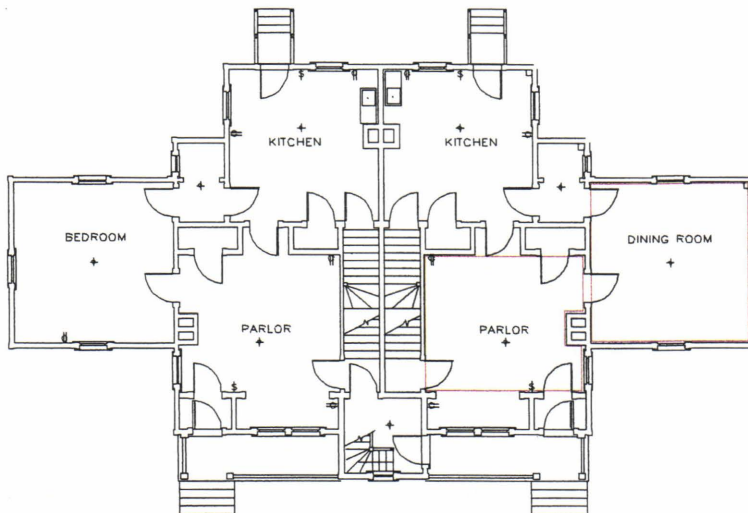


Foundation

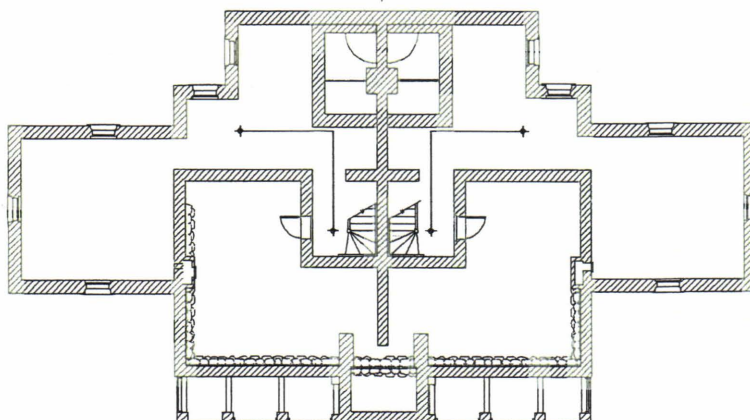
Episode IV: 1958-1974



Second Floor

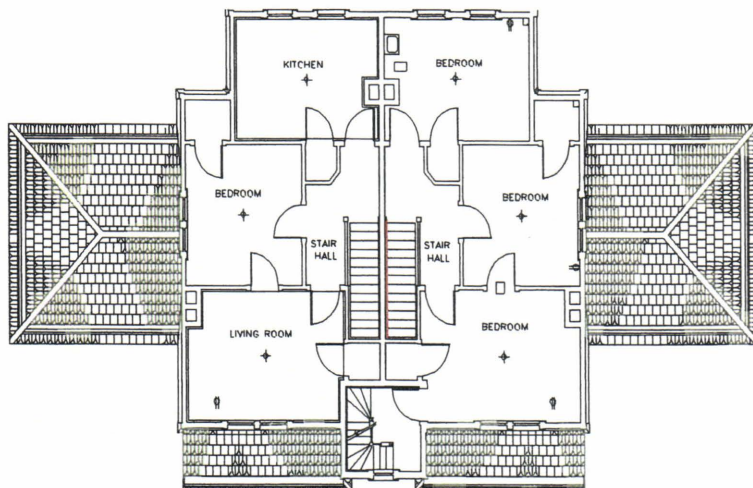


First Floor

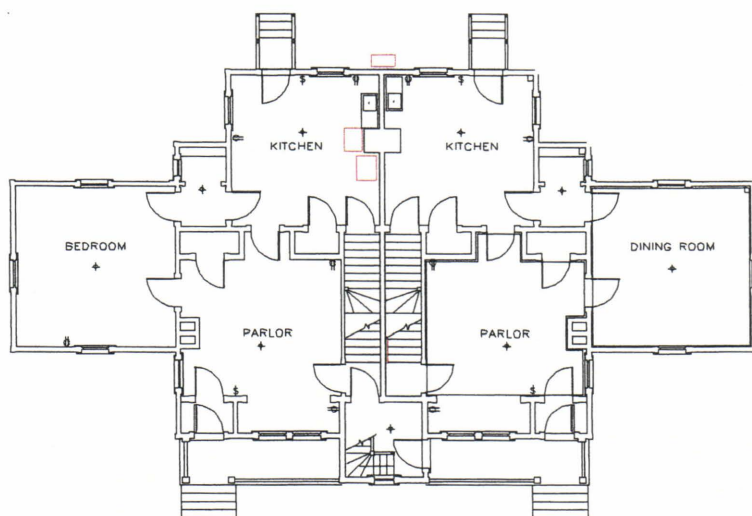


Foundation

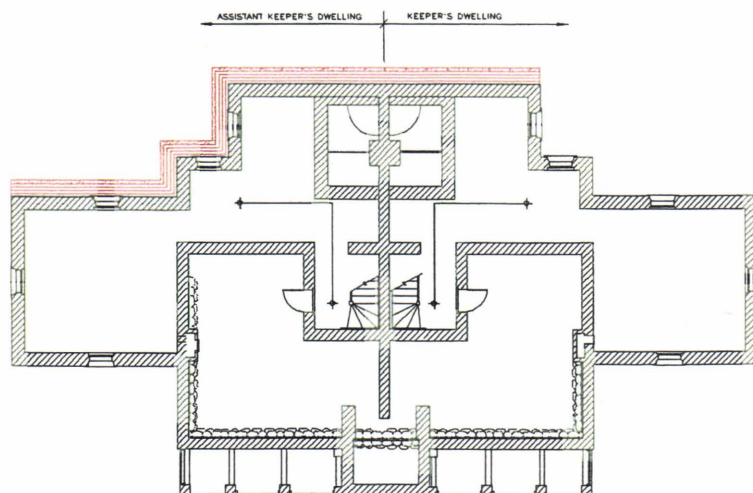
Episode V: 1975 - Present



Second Floor



First Floor



Foundation

Related Site Chronology

The entire site of the Raspberry Island Light Station has continuously evolved since its initial establishment. Many of the site changes that occurred were the direct result of keepers expressing their individuality through the manipulation of the surrounding site. While the keepers were required to follow strict regulations and guidelines regarding the maintenance and finishes of the individual structures, as stipulated by the Lighthouse Service, there were few, if any, regulations placed on the keepers with respect to the actual site. This allowed the keepers and their families the opportunity to alter the site according to their personal needs and desire for self expression. Historic documentation and photographs show changes to the site such as garden layouts, chicken coops, stables, and fence perimeters- changes that were generally a direct correlation to the keeper stationed at Raspberry Island. Often when a new keeper arrived, he would remove or change what the previous keeper had done, preferring to start anew.

Analysis of Site Episodes

Site Episode I: 1862 - 1892

Significant Site Alterations: Original building, wood stair, boathouse. Fog signal building and brick oil house not yet constructed.

The first building erected on the site was most likely some form of temporary shelter for the work crews constructing the lighthouse. There is speculation that this original shelter is the extant one-and-a-half story structure at the southeast corner of the site, although there is no documentation to support this. In addition to the one-and-a-half story structure being erected, its function unknown, the lighthouse and a corresponding privy were also erected. There is no photo documentation of the privy at this time, but it is assumed to have been east of the lighthouse, which would have hidden it from view in historic photographs of the period. The existing privy may be the original, since there is no known documentation of it ever being rebuilt or moved.

The characteristics of the site led to other structures, in addition to the lighthouse, being constructed such as a wood stairway leading from the water's edge up the bluff to the lighthouse. The steep bluff presented quite an obstacle, especially when transporting supplies from the docks to the light station. Stairs to alleviate this

difficulty were requested by the district engineer as early as 1868, however, it took five years for this request to be authorized. The station journal of 1873 states "new stairs and a dock crib [were] built."¹³

The earliest evidence of a boathouse at the station is provided by a journal entry written in 1878, which states that the "U.S. Lighthouse Service engineers came here to build a boathouse and paint the lighthouse."¹⁴ According to the *Historic Data Section* prepared for Raspberry Island by David Snyder, the first boathouse was located three-quarters of a mile from the lighthouse at the sand spit. This location was likely chosen because it was a stretch of beach that was more protected from the vicious weather than the waterfront area at the base of the lighthouse. In 1871, a Chicago minister who visited the island to baptize the keeper's children, described in his diary a walk three-quarters of a mile long from the docks to the lighthouse in which he carried supplies, as it was still two years before stairs were built from the base of the bluff up to the lighthouse.

A significantly large portion of the south end of the island was cleared, in conjunction with the construction of the lighthouse, to allow ships maximum visibility of the light without the hindrance of trees. However, the area immediately surrounding the lighthouse was kept very small. A wood rail fence painted white defined a tight perimeter around the station.

Site Episode II: 1893 - 1905

Significant Site Alterations: Original building remained unaltered, fog signal and wood tramway constructed.

A new boathouse was constructed in 1893 at the base of the bluff in approximately the same location as the extant boathouse. At the same time, the boat dock at the base of the bluff was extended and repaired to accommodate the new boathouse. This saved the inconvenient 3/4 mile walk between the lighthouse and the former boathouse and docks.

Historic documentation suggests that both the defined perimeter around the lighthouse, as well as the type of fence marking it, were frequently changed. Historic photos indicate, for example, that the painted wood rail fence described in Episode 1 was removed by 1896. That same year, keeper John Eddy, "built and whitewashed a fence" around the cleared area of the light station.¹⁵ The size and

style of the fence is unknown, however, it too, was probably replaced by the next keeper.

There is little information regarding the number of outbuildings at the site during this period. One journal entry states that the keeper, "whitewashed [the] outhouses," which indicates that there was more than one. It can be assumed that one was the privy and the other one(s) was a storage facility. In 1904, an additional outbuilding was constructed. An entry in the station's journal states that a, "woodshed [was] built at a cost of \$175.00." [16] A 1904 photograph (Illustration 6) shows an outbuilding that appears to be located directly behind, and east of, the one-story kitchen wing of the lighthouse. Although in the same location as the extant woodshed as seen in Illustration 7, the massing of the structure in the photo, the location of the door and a small window, and the use of clapboard siding (as opposed to the current board and batten) all indicate that the two structures are not the same building. (Illustration 6 and 7).

Further documentation states that a walkway from the west [main] entrance extended around the south end of the lighthouse to the rear. This walkway was most likely made of wood planks, and led to the privy, woodshed, and any other outbuilding located east of the lighthouse.

The brick oil house was constructed in 1901, at a good distance from the lighthouse, in order to store the highly flammable kerosene, which was the fuel for the light. The construction of this structure took only a few days. As was typical, a standard design, developed for use by other stations around the Great Lakes, was employed to construct the building, and an experienced construction crew sent by the U.S. Lighthouse Service to erect it.

In anticipation of the upcoming fog signal construction, a tramway was built from the boat dock, up the bluff, alongside the existing wood stairway. This wood tramway held a tram which was later used to carry the equipment, materials, and supplies needed for the construction of the fog signal building up the bluff (Illustration 8).

The fog signal building was constructed in 1903. It, too, was built using a standard design plan developed by the district engineer, thus the same structure may be found at other light stations throughout the Great Lakes. A hoist

Illustration 6



View of the lighthouse and the 1904 woodshed looking southeast, ca. 1904.

Illustration 7



View of the current woodshed looking east from the tower, 1995.

Illustration 8



View of the wood tramway looking south, ca. 1920s.

room was constructed at the far south end of the building as a separate, yet attached structure. This structure housed the winch that hoisted the tram up the tramway.

Other changes occurred during this episode as well. One was the insertion of a window "in the upstairs of a shed," as noted in a journal entry of 1904. It is not immediately known which building the keeper is referring to when he states "shed." It is likely that he is talking about the one-and-one-half story "warehouse," as the extant structure does have a window at the second level. Another change on the site occurred with the layout of a croquet ground in 1905.

Site Episode III: 1906 - 1947

Significant Site Alterations: Lighthouse addition and alterations, dormer added to fog signal, new concrete tramway and concrete sidewalks constructed

This episode began with a series of changes which, in turn, provided the impetus for several other changes as well. Many of the changes were in direct relation to the construction of the fog signal building, and the additional people needed to maintain and operate the signal. Housing was needed to accommodate the extra staff and their families, so alterations commenced on the keeper's dwelling. While the alterations were in process, the keepers and their families sought temporary residence in some of the existing outbuildings. A journal entry in 1906 states that the keeper, "moved from the dwelling to a temporary house..."¹⁷ There are several indications that the one room "shack," east of the lighthouse, had already been occupied as a residence or used as a kitchen. For example, there is decorative interior wood trim around the door and the two window openings suggesting that the interior was finished quite early. The profile of this trim appears to date to the late 19th century, prior to the 1906 alterations of the lighthouse, as seen in the Episode I drawings. Also, there is a concrete chimney alongside the east elevation of the building, which appears to have been constructed after the structure itself. It has settled and sloped away from the wall, and the concrete shows the profile of the clapboard siding, suggesting that it was poured right up against the structure. There is also a sheet metal patch on what was probably the opening for the stovepipe connection. These indications suggest that this was one of the "temporary houses" used during the 1906 construction.

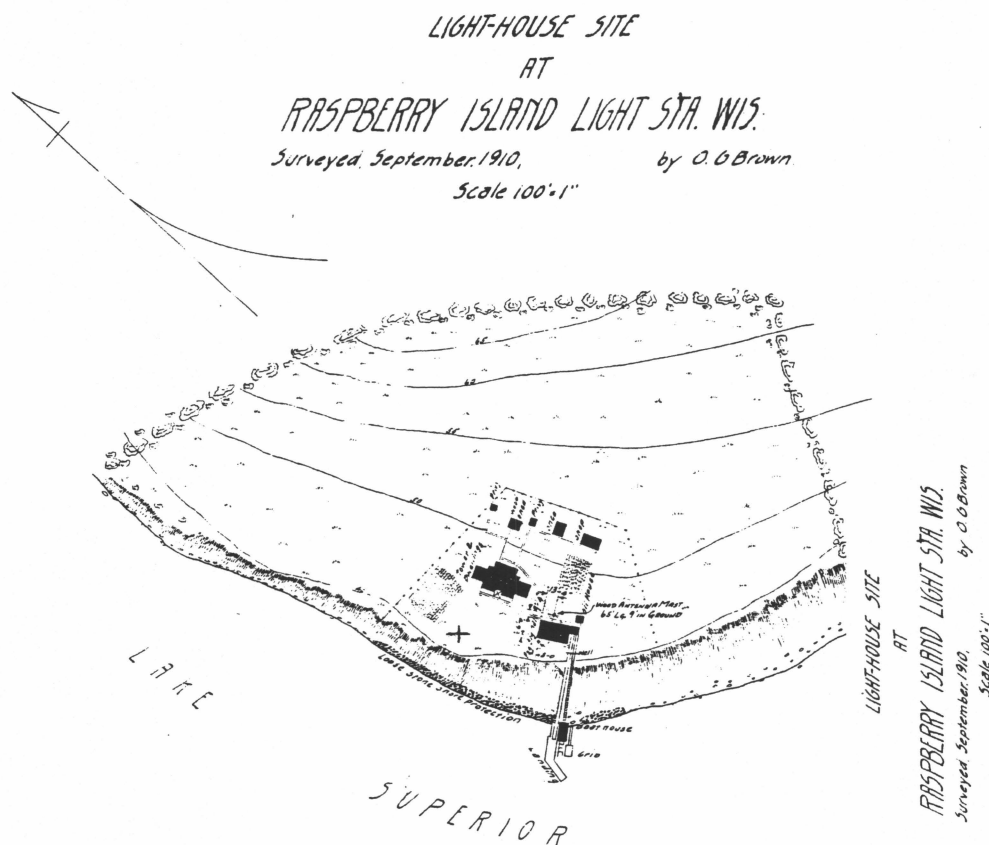
By 1909, the fence perimeter and style had changed once again under the direction of keeper Alexander McLean. Keeper McLean constructed an entirely new fence that consisted of whitewashed cedar posts with wire mesh attached between the posts. This allowed an open looking fence while providing some protection for children and animals. Keeper McLean also built a cow stable out of logs and a chicken coop.

The "Detailed Description of Premises" undertaken in 1910 provides a vivid account of the site at this time. Outbuildings that existed on the site at the time the report was written included: the woodshed, barn, workshop, oil house, and fog signal. A garden is listed as encompassing approximately 1/10 of an acre. The Description states that the "water supply for fog signal from the lake into well in outing angle of landing pier, ...covered with a housing of 4' x 4' x 4' high."¹⁸ The Description also states that the "concrete walks have been built in front of the dwelling and to the fog signal and oil-house," but "wooden walks connect the outbuildings with each other and the dwelling."¹⁹ The map drawn to supplement this written description (Illustration 9) indicates the peak development of the site. With the exception of minor changes, the site has, from that point forward, remained unaltered to the present. In fact, all of the extant structures are present by 1910, as indicated in Illustration 11, dated ca. 1910. Two elements of the 1910 site which are not, however, are the garden northwest of the lighthouse, and the wood antennae mast just east of the fog signal building.

By 1913, the layout of the outbuildings at the rear, or east end, of the lighthouse resembled what they are today (Illustration 10). The photo shows the one and one half story "warehouse" or barn with a metal smoke stack, which most likely was part of the cook stove mentioned in the keeper's journal entry of 1913, which said that the new second assistant, "...set a cookstove upstairs in the warehouse to do his cooking..."²⁰ Again, it is hard to determine if the entire structure was used as a dwelling or if the second assistant actually lived in the lighthouse and only used this building as a kitchen. The current "Gardener's Residence," the board and batten woodshed, and two privies are all also visible in Illustration 12, and are in the same locations as they are today.

The last evidence of the wood staircase alongside the tram is shown in a photo dated 1920 (Illustration 11). The staircase possibly remained until 1932 when the new concrete tramway was constructed. This new concrete tramway, which incorporated both rails for the tram and

Illustration 9



Map drawn in 1910 to accompany the "Detailed Description of Premises," written by the district inspector.

Illustration 10



View of the outbuildings east of the lighthouse, ca. 1913.

concrete steps for individuals, was modeled after one that had been recently completed at Michigan Island in 1928.

Evidence of one other fairly large structure, that is no longer extant, dates to ca. 1915 - 1920. Keeper Benton states in a journal entry that he built a "hard coal house" which was "at [the] east end of [the] signal," and that he took down the "old coal house."²¹ In Illustration 11, there appears to be a dark image between the fog signal building and the one-and-one-half story "warehouse." This may be the hard coal house Keeper Benton mentioned. Regardless, by 1929, this structure was gone. It appears that the new keeper made a new coal bin inside of the woodshed and dismantled the "old coal house at [the] east end of signal."

There is evidence, in the historic documentation, of continuous small changes at the site such as new swings constructed for the keeper's children, new posts for hanging laundry, and birdhouses. Illustration 12, circa 1936, reveals that, although there are no plantings, the garden plot established by the Bentons in the 1910s is still present. Also prominent in the photograph is the cobblestone bird bath in the foreground which is no longer extant. Additional historic photographs also reveal that there were several small flower gardens, delineated with whitewashed cobblestones, present at the site.

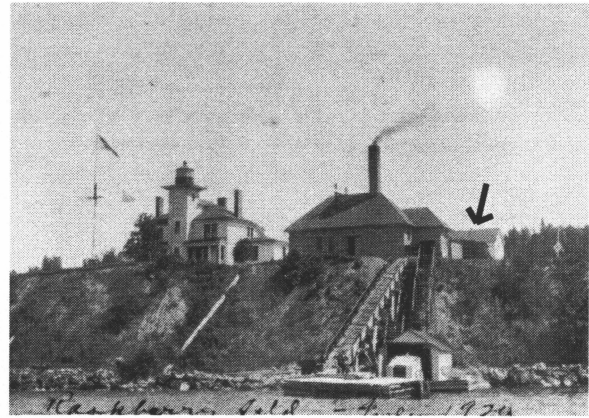
Site Episode IV: 1948 - 1975

Significant Features: Abandonment of site by government - re-growth of natural site.

By 1947 the site was virtually abandoned. No longer were the trees and brush around the site regularly cleared to keep a line of sight open for passing ships.

The last change that the Coast Guard initiated at the site was the change in the location of the light and its source. The original Fresnel lens was removed from the light tower in 1957 and donated to the Madeline Island Historical Museum. Due to the reliance on radar and radio, a light of much lesser intensity was needed. A steel pole supporting a small 160-candlepower light with an acrylic lens was constructed along the edge of the bluff, just west of the fog signal building. This light required minimal maintenance since it initially ran on batteries, and later solar power.

Illustration 11



View looking toward the site from the water, ca. 1920.

Illustration 12



View looking southeast toward the fog signal building, ca. 1936.

Site Episode V: 1975 - Present

Significant Features: National Park Service stabilization and intervention.

In 1975, the National Park Service obtained Raspberry Island and incorporated it into the Apostle Islands National Lakeshore. Site intervention by the National Park Service has been kept to a minimum, with the main focus being the stabilization of the structures and maintenance of their current conditions. The small number of physical changes that the Park Service has undertaken have included such things as a water service upgrade accomplished by the installation of a new water pump in the boathouse, as well as the construction of a "water tower" directly behind (east) the one-and-one-half story outbuilding now referred to as the "Ranger's Residence." The exterior of the water tower is board and batten painted white, which is consistent with the historic material and construction at the site. Its unobtrusive location

(and appearance) also keeps it out of sight from the general public, thus not disturbing the period interpretation of the station. The Park Service has also reconstructed new docks in their original historic location and configuration. The historic tramway is still used by Park Service staff to hoist maintenance equipment up to the site.

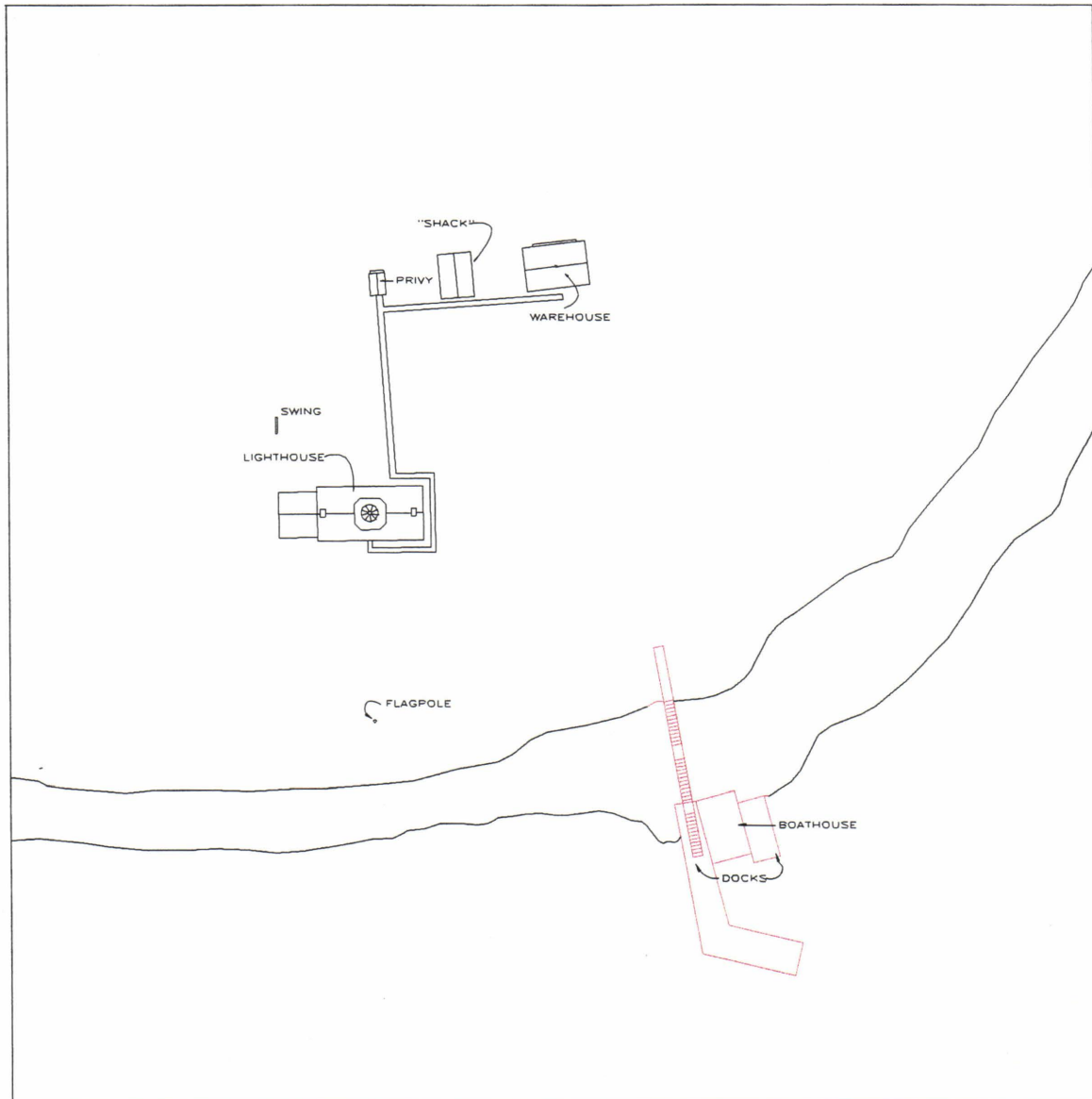
Only one major undertaking has been implemented by the Park Service, which has had a definitive effect on the site. In 1981, Park Historian Kathleen Lidfors initiated the reconstruction of the historic gardens at the station. Through analysis of historic photographs and oral interviews, the gardens were reconstructed to represent those of the 1920s (although there is evidence of these gardens up until at least the late 1930s), particularly those planted and maintained by Keeper Benton and his family from 1914 through 1924.

Conclusion

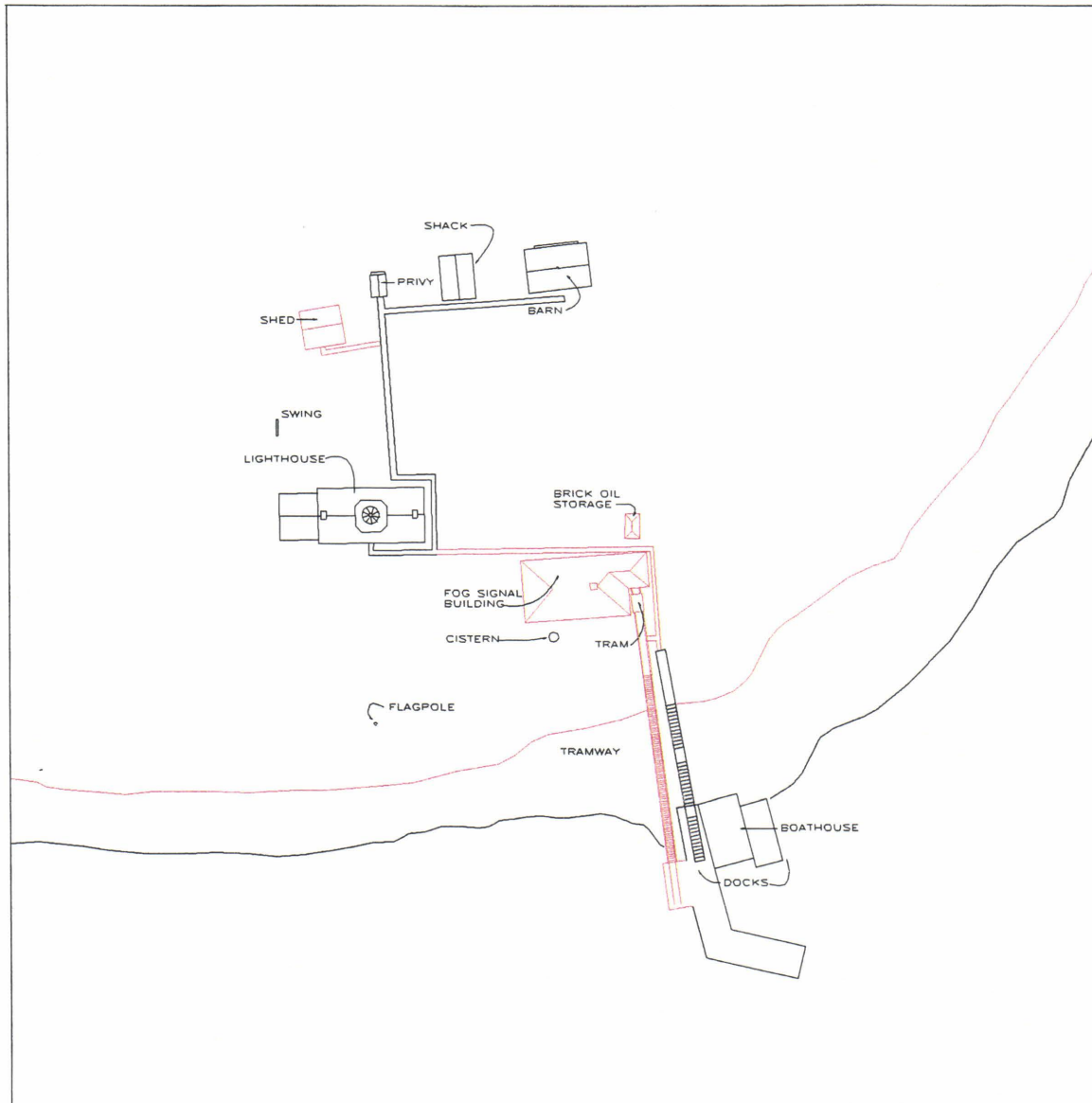
The physical appearance of the site of the Raspberry Island Light Station has undergone several changes throughout its 133 year existence. These site changes can be approximately divided into five periods of significance of their own accord. Some of these changes necessitated changes to the lighthouse and vice versa. Other site changes had little or no effect on the lighthouse such as the planting of gardens.

The year in which site intervention peaked was 1947. From the initial construction of the lighthouse in 1863 until its automation in 1947, the site was regularly cleared to maintain the original sight line established for the ships. This undertaking abruptly came to an end with the abandonment of the site. Although the National Park Service has maintained the immediate site surrounding the lighthouse and outbuildings as it was in the 1930s, the brush beyond this immediate area has grown up, diluting the boundary line that had been maintained for over 80 years. In addition, the edge of the bluff has been continually eroding, moving closer and closer to the lighthouse and the fog signal building. The fog signal building will soon be in immediate danger of foundation damage which could lead to ultimate structural collapse.

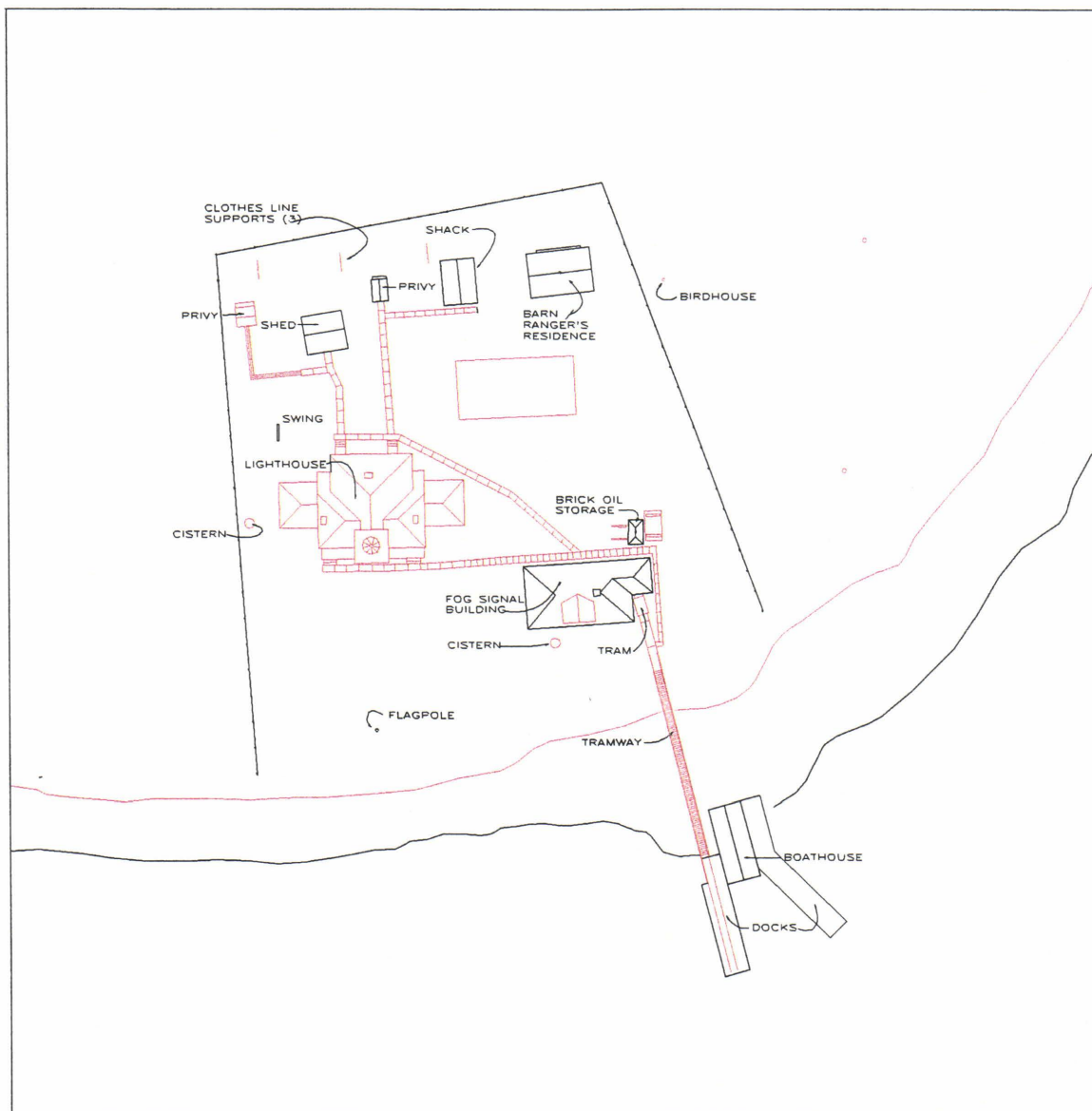
Site Episode I: 1862 - 1892



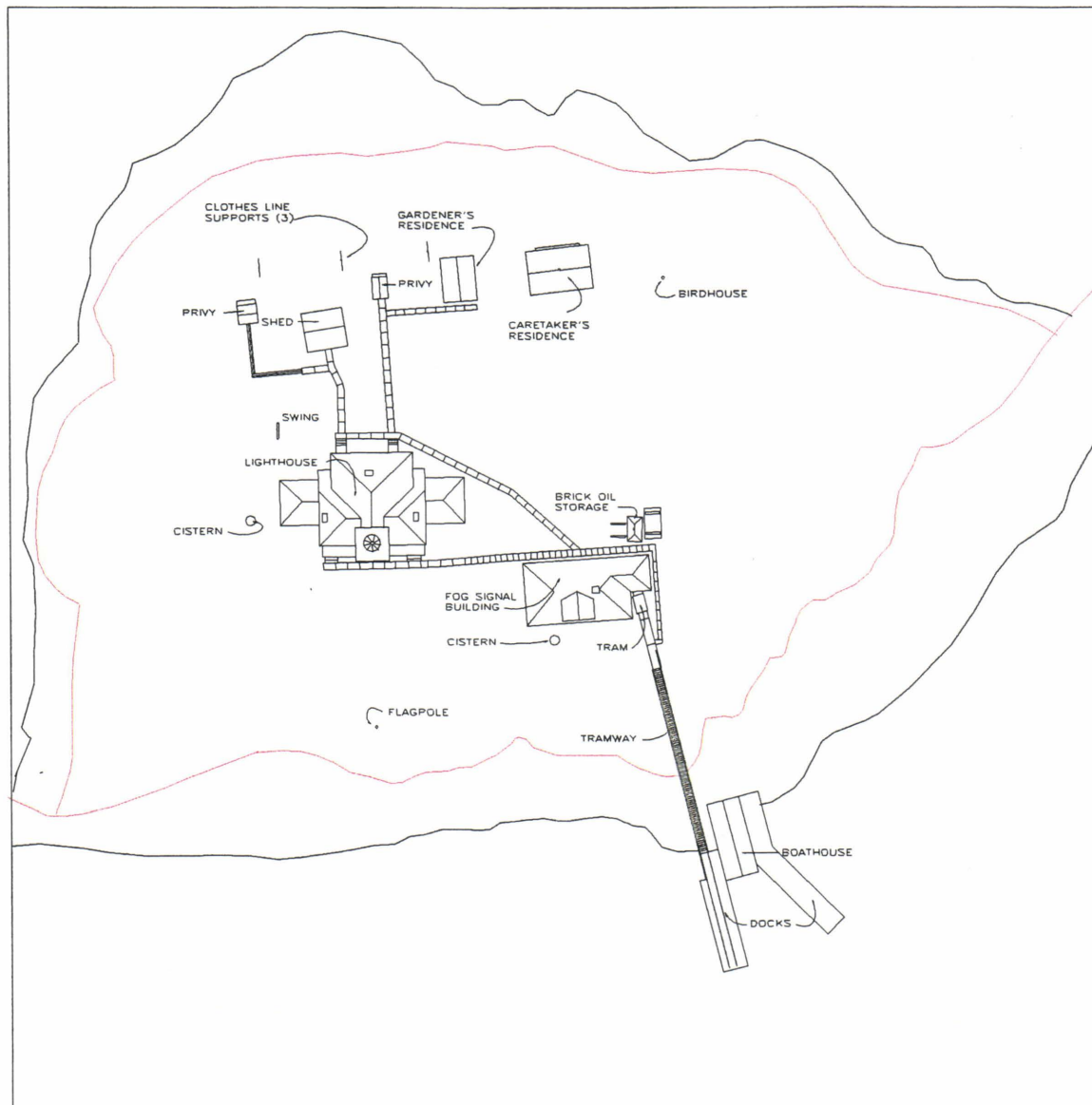
Site Episode II: 1893 - 1905



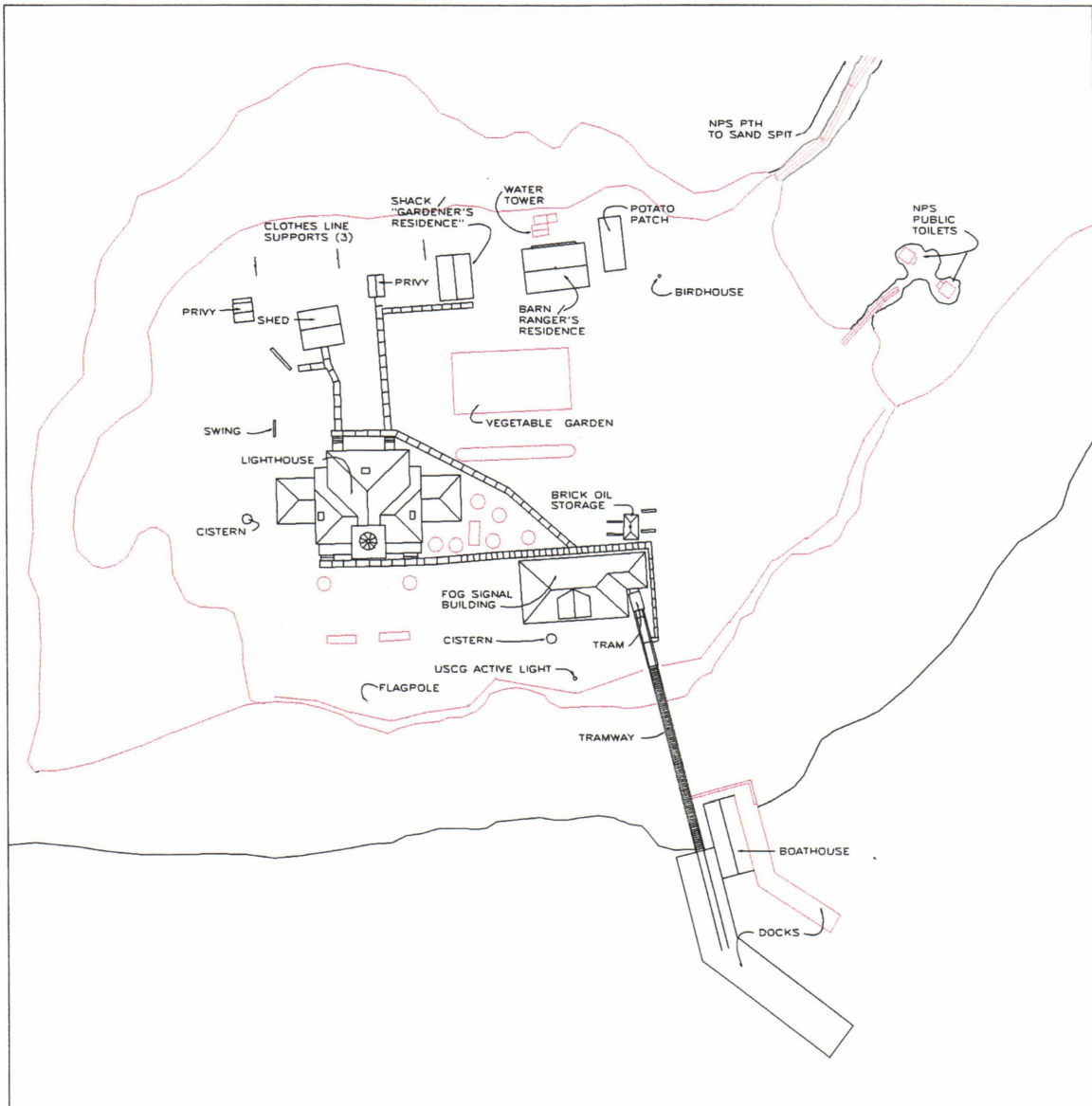
Site Episode III: 1906 - 1947



Site Episode IV: 1948 - 1975



Site Episode V: 1975 - Present



Part F:

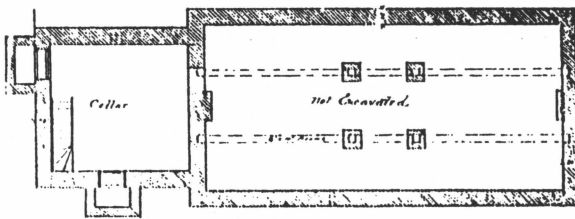
Existing Conditions

Illustration 1



View looking west at the central protruding wall in the south half of basement, 1995. Note the heavy timber beam with notched floor joists, and the exposed heavy conduit for the electrical system.

Illustration 2



Foundation Plan.

1862 drawing of the original lighthouse foundation.

Illustration 3



View in the attic looking east, 1995. Note the change in the height of the floor joists at the division of the 1863 and 1906 construction, and the collar beams tying the rafters over the 1906 section.

Illustration 4



1995 photo of the east basement wall at the south half of the basement. Note the header brick course below the window opening, and the inward bulging of the wall surface.

Part F: Existing Conditions

Systems Analysis

Structural Framing

A section of missing ceiling plaster revealed a heavy timber beam which spans east-west just south of the central masonry wall in the basement. This beam is directly below the south wall of the tower, and although not visible, it is assumed that a similar beam exists beneath the north wall of the tower. As shown in Illustration 1, the 2" x 10" floor joists spanning north-south at 16" on center are notched into this beam. The 1862 drawing of the original lighthouse (Illustration 2) indicates that there were two beams spanning north-south the entire length of the lighthouse, bearing on the exterior walls and the masonry tower supports, and making it likely that the original joists would have spanned east-west, bearing on these beams. As observed, the existing joists span north-south, therefore parallel to the beams depicted in the original drawing. This conflicting direction suggests that the framing was reconstructed in 1906. However, one idiosyncrasy of this assumption is the presence of this heavy timber beam with floor joists notched into it. The use of heavy timber and joinery is more indicative of 19th rather than 20th century construction techniques. One explanation for why this situation exists may be that portions of the original 1906 heavy timber beams were salvaged and reused in the new framing system. Additionally, the 2" x 10" joists run continuously over, and also bear on the masonry walls enclosing the two stairways.

All of the floor framing of the 1906 additions is comprised of 2" x 10" joists spaced 16" o.c. which span north-south at the east end of the dwelling and span east-west at both the north and south one-story additions. A 6" w. x 8" h. beam spans 6' - 9" east-west from the crawl space to the east exterior wall. Physical investigation revealed that this beam was exposed below the plaster ceiling at the south half of the basement. In addition, missing plaster in the north half of the basement revealed a steel channel with a 4" wide bottom flange spanning a small opening that connects the basement area beneath the kitchen to the basement area beneath the one-story addition (Structural Drawing 1). Previous physical investigation by Enviroscience, Inc. revealed that the front porches have four 6" x 8" beams each which span between the foundation wall and the brick porch piers. 2" x 6" joists span between and are presumably notched into these beams.

The second floor framing was observed through the openings of the two heat registers in order to avoid destruction of the historic fabric. The floor joists observed at the west (1862) section of the second floor are 1-3/4" x 9-3/4", and span east-west at 16" on center. The same size joists and spacing were observed at the east section (1906 addition) as well, however, they span north-south, as seen in Structural Drawing 2.

The attic floor framing of the original 1863 structure consists of 1-3/4" x 6-1/2" joists running east-west at 18" on center, however, at the east (1906) section, the joists are 1-3/4" x 9-3/4" and span north-south at 16" on center. Illustration 3 shows the distinct edge at the intersection of the two different height joists. All of the roof framing consists of 2" x 6" rafter joists spaced 16" on center, with the rafters above the east section tied together with 2" x 6" collar beams, suggesting the entire roof was reconstructed in 1906 (Structural Drawing 3).

Foundation

The exterior basement walls are red brick laid in stretcher bond course. One course, below each window, consists of headers the entire width of the opening, as seen in Illustration 4. Areas of darker mortar throughout the basement indicate the color incompatibility of the tuckpointing done in 1977.

There is evidence of failure along the east wall at the south half of the basement. The brick under each window is bulging inward just below grade. Additionally, both the south and east wall at the south half of the basement has experienced an inward bulging approximately 1/2" off plumb of the entire wall surface (Illustration 4).

Lateral expansion between the stone and brick has created a vertical joint between the two materials at the north face of the north crawl space wall. This joint has been tuckpointed, but appears to have widened since, as seen in Illustration 5.

Excavations were undertaken around the foundation of the structure in 1991. Sections of the test pits were drawn by Enviroscience, Inc., and are shown in the excavation drawing (produced by Enviroscience, Inc.) at the end of this section. Two important indications of these

Illustration 5



Photo looking south at the north face of the crawl space wall, 1995. Note the lateral expansion between the rough stone and brick wall surfaces.

section drawings are: the bearing condition at the exterior wall and the movement that has taken place at the brick porch piers. Enviroscience, Inc. also notes that there are no footings beneath the tower walls.

Mechanical

Wood and coal burning stoves were originally used to heat the dwelling. The locations of these stoves are suggested by the location of the metal stovepipe hole covers at the chimney face in most of the rooms. In addition, holes were cut through the flooring system at the south half of the dwelling (the keeper's dwelling), and covered with metal grilles. There are two of these "heat registers," one in Room 202 just east of the chimney, and one at the threshold of door 204.3, between Rooms 204 and 205. There is no evidence of these grilles, however, at the north half of the dwelling.

Currently there is a contemporary, liquid propane, gas-fired, cooking range in the north kitchen and two 100-pound liquid propane tanks enclosed in a metal cage along the east elevation at the exterior of the building.

The structure was unoccupied and not heated during physical investigation. However, portable liquid propane heaters have been installed and supply heat for two of the outbuildings, the "Ranger's Residence" and the "Gardener's Residence". The heater in the Ranger's Residence, the one-and-a-half story structure historically referred to as the "warehouse," has a metal vent stack which bends in the attic space and extends through the historic vent stack opening.

Plumbing

On the west elevation, there are currently two downspouts located at the north and south ends of the tower. The historic drainage drawing (Illustration 6) indicates that these downspouts once fed into boots which led to the perimeter drain tile. This drain tile diverted excess water to a large drain pipe that had an outlet at the side of the bluff. Today, however, the downspouts no longer lead into the boots. They have been cut a few feet above grade, and are connected to PVC pipe, which extends approximately 6'-0" from the face of the tower, thereby allowing the water to drain directly onto the ground surface (Illustration 7).

On the east elevation, there are currently six downspouts all in their original 1906 locations. All of the boots into which they drain are non-historic replacements made of PVC, except the far north boot which is still red clay. The downspouts themselves are also non-historic. They were replaced in 1979 as part of the National Park Service's maintenance work which stated, "...install proper drainage around [the] building by repairing walks, installing new downspouts, and subsurface drains."¹ Historically, all six of these downspouts fed to drain pipes which emptied into the two brick cisterns in the basement. The stored water was hand-pumped from the cisterns at the kitchen sinks directly above. At some time prior to abandonment of the station in 1947, the north downspouts were changed to divert water to an exterior concrete cistern located just north of the lighthouse. When the new drainage system was installed in 1979, all of the downspouts were rerouted so that they fed not into the cisterns, but into a new site drainage system.

The new drainage system included the current perimeter drain tile which was fed by all of the downspouts. An interceptor ditch runs the length of the east edge of the site and continues around the north edge of site. This ditch is fed by natural site drainage and by the discharge from the perimeter drain tile. The swale widens north of the lighthouse and apparently drains directly down the edge of bluff, expediting the already excessive erosion of the bluff.

Illustration 6 indicates a drain running between the lighthouse and the fog signal building that appears to have led overflow water from the lighthouse cisterns to the edge of the bluff. Illustration 8 shows that a trough was constructed from this drainage line down the side of the

[illegible]

Illustration 7



Existing Conditions

bluff to the water's edge. The historic drawing (Illustration 6) indicates that this drain was "closed off" or possibly just buried in 1931. Currently, at the location where this drain would have met the bluff edge, there is indication of accelerated erosion, as seen in Illustration 9. This indicates that water may have continued to naturally flow toward this area after the trough was removed.

The fog signal building also has a cistern which collects water from its downspouts. The overflow from the cistern is drained through an underground drain pipe which protrudes from the bluff edge approximately 8," allowing water to drain directly on the side of the bluff. The excessive erosion this has caused is evident in Illustration 10.

There are two sinks on the first floor, one in each of the kitchens. They are painted cast iron with attached sloped drain boards and appear to date to the 1940s. A ghosted image of darker paint, and the alteration of the wainscot around both sinks, indicates the profile of a previous, (possibly the original), sink in each room. It is known that each sink originally had a pitcher pump which drew water from the respective cistern in the basement directly below, however, neither is extant.

There is no evidence of hot water service in the dwelling, but there is of cold water. Cold water pipes leading to the second floor kitchen are exposed and run through large holes cut into the historic floor and ceiling fabric at the southeast corner of the assistant keeper's kitchen, Illustration 11. The sink, into which these pipes feed, is also painted cast iron, has a drain board, and appears to have been installed in the 1940s as were those on the first floor, however, the style of the second floor sink is much different. In the late 1950s, Ellerbee Architects installed a porcelain sink in the southeast bedroom at the second floor and connected it to the existing cold water pipes.

The only toilet facilities on the island are public outhouses with vault systems which are located just south of the site. The facilities were installed, and are currently maintained, by the National Park Service.

The generator in the fog signal building (described in electrical section) operates the water pump in the boat-house which fills the 200-gallon water tank directly behind (or east of) the one-and-a-half-story "Ranger's Residence," historically referred to as the "warehouse."

Illustration 8



Photo of the lighthouse site from the water, ca. 1920. Note the trough-type drainage line constructed down the slope of the bluff.

Illustration 9



Photo of the bluff area where the historic drain was originally connected to the trough-type drainage line, 1995.

Illustration 10



Photo showing the severe erosion of the bluff at the drainpipe outlet just north of the tramway, 1995.

Illustration 11



View of the southeast corner of the assistant keeper's kitchen showing the 1940s cast iron sink, the ghosted image of a former sink at the wainscot, and the cold water pipes leading to the second floor, 1995.

Electricity

Most of the extant light fixtures in the dwelling appear to be the original 1941 fixtures. Several of the fixtures, especially at the second floor, are rusted due to water infiltration through the ceiling. Water has also deteriorated the ceiling plaster around the fixtures, thus accelerating the damage caused by the weight of the fixtures. The fixtures are mostly switched lights at the first floor and have pull chain operation at the second floor. Each room has at least one electrical outlet. They are all single outlet receptacles except those in the first floor kitchens which are duplex outlets. The electrical panel is located at the first floor of the light tower and was locked, thus inaccessible during physical investigation. All of the observed wiring at the first and second floors is enclosed in flexible metal conduit running between and lying directly on the wood joists. The electrical wiring in the basement, on the other hand, is exposed, heavy, galvanized, threaded conduit that is attached to the underside of the plaster ceiling. Maintenance records from 1987 indicate that a 110 volt power supply was installed and the power changed from AC to DC that year.

Currently, there is a 15 kW generator that was installed in 1984 in the fog signal building with a 150A load center (panel). There are three visible feeds: (1)-5 HP water pump at the boathouse, (1)-5 HP winch adjacent to the fog signal building for hoisting the tram, and (1) battery charger. The generator runs intermittently and supplies the electricity for the "Ranger's Residence" and the "Gardener's House," and powers both the water pump in the boathouse and the hoist for the tram. Physical investigation also revealed a bank of Exide batteries stored in the fog signal building. These previously supplied 12 volt power via the 1940s distribution panel which is no longer in use.

The original 1940s system consisted of:

...two 2 kW 115 VDC generators, a manual transfer switch, relays, main circuit breakers, electrical characteristic metering and branch distribution circuit breakers. These branch circuit breakers served loads as follows: signal lights, flasher #2, dwelling, Fog Signal Building, radio phone, boathouse, main Lighthouse and four spares. All circuits remained in the Fog Signal Building except the dwelling circuit. The direct buried feeder wires, estimated to be size 4 or 6 AWG, went to a flush panel in the existing Lighthouse tower.²

The PVC conduit which extends above grade at the base of the tower at the west elevation indicates the former underground electrical feed to the light tower.

Architectural Barriers

Access onto the site itself creates the greatest barrier for handicapped accessibility. Currently the height difference between the boat landing and the site is approximately 40'. Access between the two levels is provided by a concrete tramway. Illustration 12 shows the tramway with its rail system from the boat dock. Goods and equipment are transported up the tramway in a tram which is hoisted by an electrically powered winch directly above (Illustration 13). Visitors, however, must access the site by climbing 76 concrete steps between the rails on the tramway, as shown in Illustration 14.

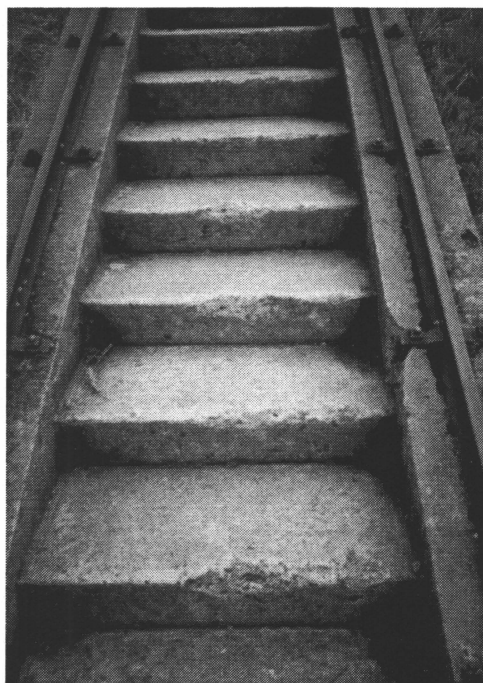
Once on the plateau of the historic site, the fog signal building has three door openings with stone sills and double-leaf doors. The east and west openings are 4' - 8" wide with sills that are currently 10" above grade. The north opening is 5' - 2" wide with a sill that slopes from 7" to 8" above grade. The dwelling is currently less accessible with the first floor level approximately 2' - 8" above grade, and the second floor and light tower

Illustration 12



View looking east from the dock toward the concrete tramway and rail system, 1995.

Illustration 14



Detail of the concrete tramway, 1995.

Illustration 13



View looking northeast at the fog signal building and the hoist room, 1995. The wood tram may date to 1932.

Illustration 15



Detail view of the roof above the one-story south end of the lighthouse, 1995. Note the shingles that are pulling loose.

currently only approachable by stairs. The rear exterior door openings are 34" wide and the interior door openings on the first floor are 32". All of the other related outbuildings appear to have openings in which handicapped accessibility could be readily achievable.

Exterior Fabric Analysis

Roof: The roof is covered with stamped sheet metal shingles which have a raised decorative pattern. The shingles are painted a deep red with little paint buildup observed. National Park Service records state that the shingles were painted in 1978 and again in 1992. There are, however, many areas of peeling paint on the roof surface where oxidation has taken place and generous amounts of rusted metal are exposed.

The shingles have interlocking edges, which initially required minimal mechanical fasteners for their installation. Several of the shingles apparently became loose at some point and were repaired by the National Park Service in 1976. The nails and neoprene gaskets used to secure the shingles, and the unusual nailing pattern that resulted, provide evidence of the repairs. Because of this surface nailing, the potential for water infiltration and further oxidation of the metal is greatly increased. In addition, some of the shingles are continuing to pull loose from the roof surface, especially at the south end of the building, as seen in Illustration 15.

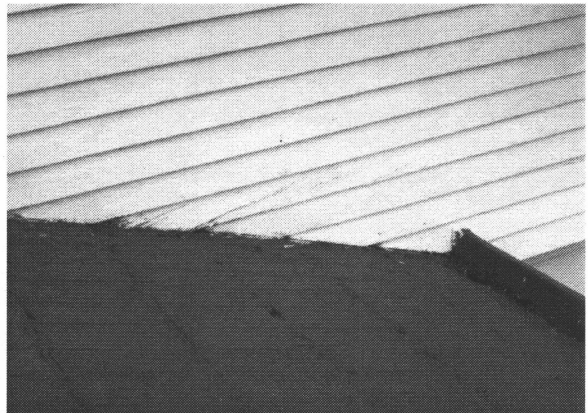
The building has a built-in gutter, often referred to as a "Yankee" gutter, which is comprised of a continuous wood member with a trim piece attached below. This gutter is attached directly onto the surface of the shingles along the sloped roof surface approximately 12" above the end of the overhang. The gutter is covered with sheet metal flashing that is painted red. The paint, however, has failed due to buildup in several areas, leaving the metal exposed and accelerating oxidation. The portion of the gutter that is not covered with metal flashing is uniformly weathered across its entire surface. The paint on the wood surface of the gutter has also failed in several areas, and there is evidence of rot in many locations. These areas of failure indicate that the preventative measures taken, including paint removal and preparation of the metal surfaces of the shingles, were not done at the significant areas of flashing. It appears that in these "hard to get locations" the paint was not sufficiently removed. Illustration 16 shows the deteriorated built-in gutter and the paint build-up causing the failure of the step flashing at the chimney. The step flashing at all three chimneys is failing and pulling

Illustration 16



Detail of the south chimney, 1995. Note the deteriorated wood along the bottom side of the built-in wood gutter and the failed flashing, both at the gutter, and stepped along the chimney face. The incompatible color and joint size of the tuckpointing is also evident.

Illustration 17



Detail at the south end of the lighthouse of the one-story roof meeting the two-story wall, 1995. Note the deteriorated clapboard siding at the intersection of the two surfaces, most likely caused by a combination of snow build-up, and the lack of proper flashing.

loose from the chimney surfaces. There does not appear to be any flashing at any of the roof and wall intersections. This has allowed water to penetrate into and through the wood clapboard siding. Examples of this at the interior are evident at the intersection of the porch roofs with the adjacent wall surface. Illustration 17 displays an exterior area of damage where wood clapboard siding has deteriorated, most likely from the combination of snow build-up on the roof surface and lack of flashing at the wall.

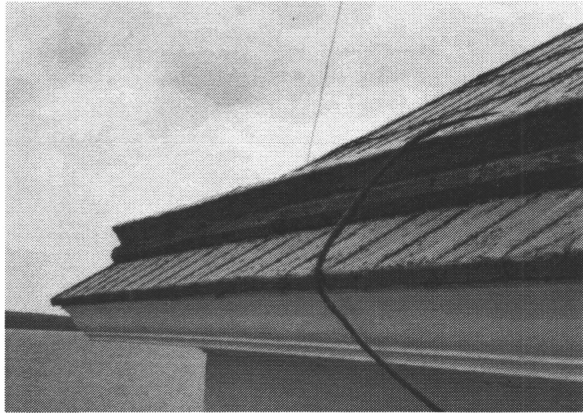
There are four metal lightning rods, one attached to each roof peak of the dwelling. Each rod has a braided copper grounding wire attached to it which runs along the roof, is hung from the wall, and is eventually buried in the ground.

The grounding wires lie directly on the metal roof surfaces and are attached directly to the wood wall surfaces. These wires appear to have been covered with several layers of red paint along the roof surface and several layers of white paint as they run down along the wall surfaces (Illustration 18).

The 1862 section of the dwelling has two red brick chimneys. Both chimneys have been extensively tuckpointed, as documented by the National Park Service in 1980. The mortar used for this repointing is not compatible with the original mortar either in color, content, or size (the joints are much wider than the original mortar joints). A few small areas have continued to experience deteriorated joints since this work was completed. Both chimneys have a galvanized sheet metal stove pipe extension rising approximately 5'-6' above the concrete chimney cap. Each stove pipe extension has three guy wire supports, two of which are attached to the main roof with one stretching west and one stretching east. The third wire is attached to the roof of the adjacent one-story building section. The guy wire at the north chimney, which had been attached to the one-story wing, is disconnected and is hanging loose.

Historic photos and documentation suggest that coal stoves were installed around 1920, as it is at this time that the stovepipe extensions first appear in the historic photographs. The stove pipe extension on the north chimney appears to be relatively new and has little rust, however, the top vent cover is missing. The stovepipe extension on the south chimney, on the other hand, has experienced excessive oxidation, especially at its base. Both stovepipe extensions have lightning protection consisting of a braided copper wire which is attached to the cap of the extension and runs along the chimney and building, then is buried at grade. The east chimney at the 1906 portion of the dwelling does not have a stovepipe extension, and there is no historical evidence of one. The concrete cap on this chimney is rough concrete and appears severely weathered.

Illustration 18



View of the lighthouse roof overhang showing the braided copper grounding wire, 1995.

Foundation

The foundation walls are exposed approximately 18" - 24" above grade, and are red brick laid in stretcher bond course. The brick was repointed in several locations in 1977 by the National Park Service. No obvious deteriorated joints were observed during physical investigation, except at the east elevation. On the north and east walls, there is a stepped pattern of hairline cracks in the mortar at the north-east corner of the exposed foundation wall on both the interior and exterior, suggesting that there has been settlement of this wall at its center or that there has been upward ground pressure at the corners of the wall (Illustration 19). The historic mortar appears to be high in Portland cement content, creating less flexible joints which are "unforgiving" to settlement. This may have contributed to the stepped cracking, and to the minor hairline cracks visible in the mortar joints of the brick porch piers at the west elevation. Furthermore, there is a parge coat visible above grade along the south foundation wall near the west end which is exposed from 6" to 8" above grade, most likely also part of the foundation work undertaken by the National Park Service in 1977.

Walls

The walls are covered with wood clapboard siding. There is a belt course at the second floor consisting of the clapboard installed with a sweeping profile, and an attached 7" crown molding, (Illustration 20). Overall, the clapboard is in excellent condition for its age of over ninety years. There does not seem to be any evidence of the typical signs of deterioration, such as cupping or splitting of the

Illustration 19

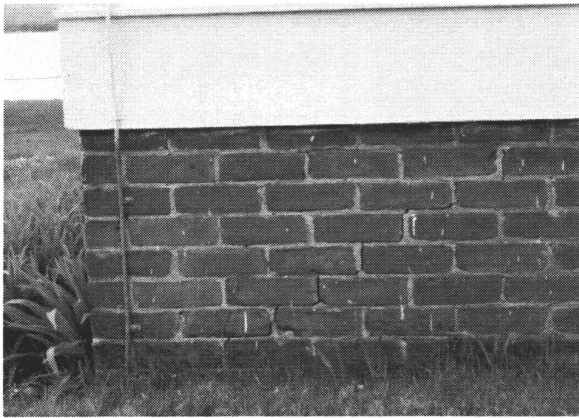
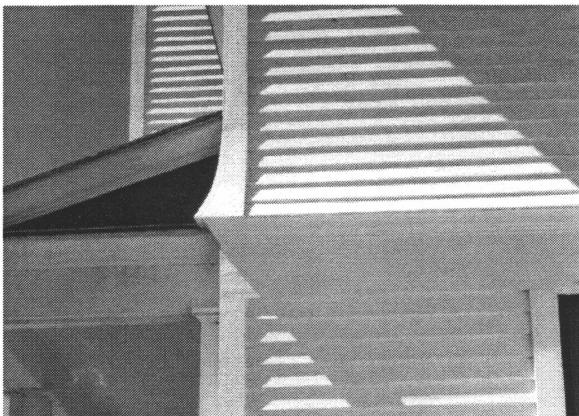


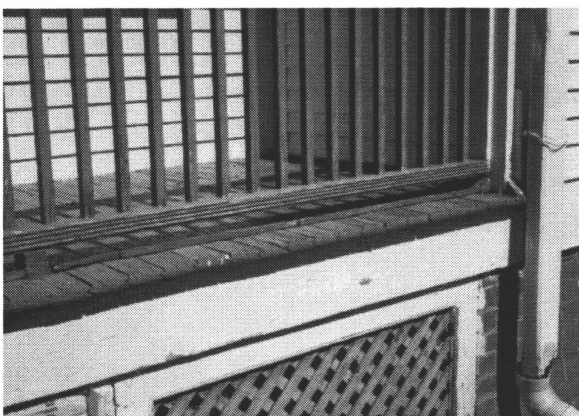
Photo of the stepped cracking along the mortar joints at the corner of the east elevation, 1995.

Illustration 20



Sweeping profile of the clapboard siding and crown molding at the second floor belt line of the lighthouse, 1995.

Illustration 21



View of the tongue and groove floor boards of the north porch deck, 1995. Many are pulling apart, and several of the "tongues" have split in two.

wood. Extensive paint removal was undertaken by the National Park Service in 1976, which involved scraping and melting the paint off of the wood surfaces. However, physical investigation has revealed evidence of paint failure in a few residual areas of paint buildup, such as at the tower siding that is near the dwelling's roof surface (likely caused by snow build-up), and at various areas of the west and south elevations (likely caused by continuous exposure to the sun and wind).

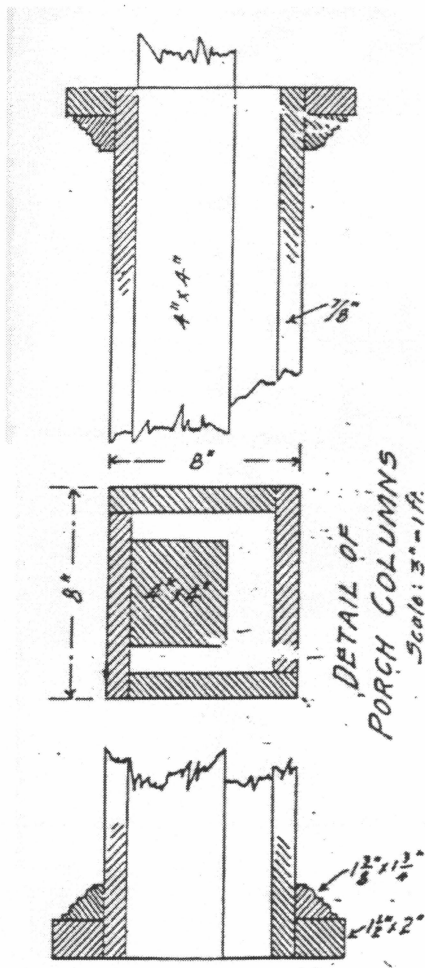
Front (West) Porches

There is extensive paint failure and weathering at both of the front (west) porch decks. This is most evident at the high traffic areas between the steps and the entrance. The individual boards are beginning to pull apart, and some of the "tongues" have split/broken apart, as indicated in Illustration 21. There is also extensive paint failure at the wood balustrade and handrails, which appears to have also been caused by paint build-up. Paint, however, was being removed from the wood surfaces by the National Park Service during physical investigation through a combination of melting and scraping.

The porch columns are 8" x 8" in plan, comprised of 1" x 8" members nailed square around 4" x 4" solid wood posts, as detailed in the original 1905 construction drawings, Illustration 22. The columns are painted and have an applied molding as a base, except at the two columns of the south porch where there is a solid base member that is beginning to rot and deteriorate. Illustration 22 shows the bases constructed with applied moldings, providing evidence that the solid member bases were added at a later date. At the top of one column on the south porch there is a small piece of extant trim molding directly below the column cap trim (Illustration 23). This molding, which has an ogee profile, appears to be the only extant piece of original trim that was intended to encompass each column, as indicated in Illustration 22.

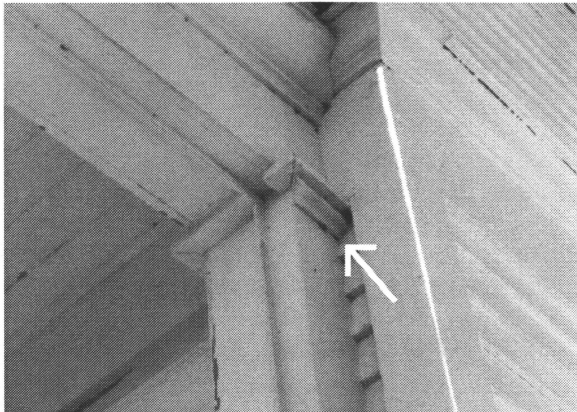
The column caps and bases have been cut and a wood frame attached to them, extending their full height. These frames are for porch screens, which are documented as first being installed by Keeper Wilks in 1931. Most of the framing at each porch still exists, and is painted the same color as the porch decking and the handrails with evidence of paint build-up. The frame along a column and cut capital at the south porch is shown in Illustration 23. The screens themselves are painted black, and are currently stored in the woodshed behind the lighthouse.

Illustration 22



Porch construction detail taken from the 1906 construction drawings.

Illustration 23



View of the column at the south porch against the wall, 1995. Note the cut in the cap and the attached wood frame used for the installation of the wood screen. The small trim molding just below the cap is the only remaining piece of the original trim (also see illustration 62).

Historic photos indicate that the concrete base, on which the south steps bear, appears to be the original. Due to ground settlement though, the concrete has cracked and seems to be continually breaking up. The wood treads have been replaced at both stairs, and a non-historic post and handrail has been constructed along the north edge of both stairs as well. The side skirts of the south stair are 2 1/2" vertical beaded boards, which appear relatively new, and do not resemble the skirt boards in the historic photos (Illustration 24).

The base at the north steps is a concrete slab that acts as the first step with brick ledges extending between the slab and the porch face, supporting the wood steps. The concrete slab has extensively settled creating a noticeable angled gap between it and the wood steps above. As evidenced in historic photos, this condition appears to have been present as early as the 1920s, as can be seen by comparing Illustrations 25 and 26. The side skirt on the north face of the stairs consists of wide, vertical flat boards resembling those which appear in several historic photos. This may be the only extant wood material of the original porch steps (Illustration 27).

The lattice and bottom wood rail at all of the porch skirts show signs of extensive dry rot, most likely due to continuous contact with snow buildup in the winters. This dry rot has led to failure of the existing paint, and the nonadherence of newly applied paint layers, as can be seen in Illustration 28.

Illustration 24



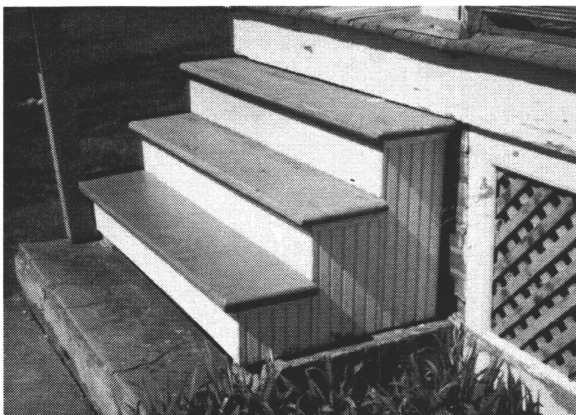
Photo looking north at the north porch's steps, 1995. Note the non-historic beaded board wood trim.

Illustration 25



Photo taken ca. 1924-29. Note that the concrete base of the steps has already significantly settled at the south end.

Illustration 26



Current condition of the steps leading up to the north porch, 1995. Note the virtually identical amount of settlement as that seen in the 1920s photo of the south end (Illustration 25a). Also note the non-historic beaded skirt boards.

Illustration 27



View looking south at the north porch's steps, 1995. The wide, flat wood boards may be the only extant wood of the original 1906 steps.

Illustration 28

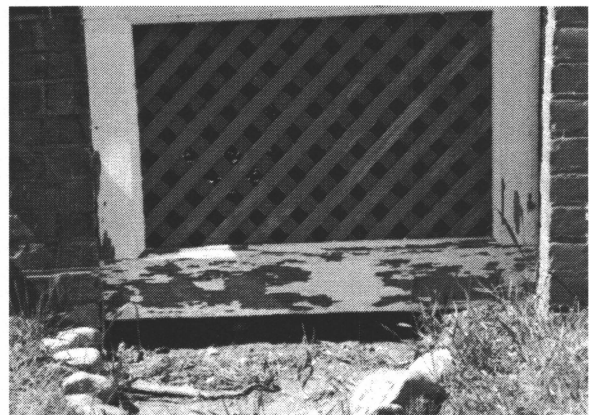


Photo showing the dry rot and paint failure at the porch skirt along the west elevation, 1995.

Rear (East) Porches

According to National Park Service maintenance records, the wood decking, steps, and handrails of both of the rear (north) porches were replaced in 1987. These reconstructed stairs maintain all of the features of the original stairs. Currently the deck, treads, and handrails are painted gray and holes have been drilled into the treads to allow ventilation of the space below, preventing the occurrence of wood rot, however, one board of the wood deck has already since rotted. Both porches have a shed roof supported by large decorative wood brackets and covered with stamped sheet metal shingles that are identical to those on the main roof.

Tower

Exterior

The tower walls are covered with the same white painted wood clapboard as the dwelling portion of the lighthouse. There is a single pane, double hung window on both the north and south elevations at the work room level, the trim of which is painted white.

The exterior surface of the lantern base is covered with a thick canvas that has several coatings of either black paint or asphalt. Whichever it is, it is excessively peeling, particularly along the south and west faces. This is probably the result of prolonged wind and sun exposure (Illustration 29). The nine-sided lantern consists of a cast iron frame with seven glass panels and two metal panels along the east side of the tower. The roof is metal and has several layers of the same black coating as the lantern base (Illustration 30). The "Detailed Description of Premises" of 1910 states that the roof consists of copper sheets riveted to cast iron ribs. The glass panels are single pane glass, with glazing putty, which appears relatively new, between the glass and the cast iron frame. A braided copper grounding wire extends from the lightning rod at the top of the cast iron ventilator ball down the side of the lantern, across the gallery deck, and down the west face of the tower into the ground. It is attached directly to the tower wall, and is covered with several layers of white paint.

The gallery deck is wood covered with copper sheet metal and is coated with the same black paint or asphalt as the lantern base. Due to the lack of an isolating material between the copper metal deck and the base of the galvanized steel posts of the guardrails, the copper deck has begun to corrode at the base of two of the galvanized steel guardrail posts, as shown in Illustration 31. Additionally, the shallow slope of the deck surface does provide proper drainage, allowing water to stand directly around the lantern base (Illustration 28).

Interior

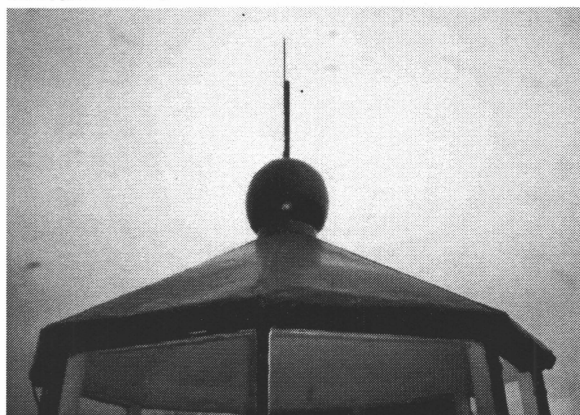
The stairs in the interior of the tower are wood and are coated with several layers of stain and varnish. The different types of varnish and stain have chemically interacted to produce an "alligatored" effect, which is evidenced on the stair treads, stringers, handrails, and posts, as well as on much of the woodwork within the dwelling.

Illustration 29



View of the lantern base showing the paint build-up over the canvas covering the entire base, 1995. Also note the relatively small slope which allows water to sit following periods of rain.

Illustration 30



Detail view of the paint build-up on the lantern's roof, ventilator ball, and lightning rod, 1995.

Illustration 31



Detail of the galvanized guardrail post meeting the copper sheet metal over the decking, 1995. Also shown is the corrosive reaction of the two metals.

The stair has a discontinuous 4" x 4" central wood post. The stair has open treads and winders. The floor boards at all four levels of the tower are maple, while the wood stair and trim throughout the tower interior appears to be fir.

At the ground level of the tower, there is evidence of excessive water damage below window 1-9, as seen by the spalling and cracking that extends from the window stool to the stair stringer. In addition, the wood window casing is beginning to pull loose from the wall surface. There are also several stress cracks extending from the window head to the ceiling, and from the head of door 106.1 west and a horizontal crack about 6'-0" above the floor along the south elevation. The floor boards are extremely weathered around the exterior door opening, and several are crushed at the center of the room. There is a marking on the floor around these damaged boards approximately 16" in diameter, which is the ghosted outline of the former weight shaft. The crushed boards, at the location of the former shaft, are likely the result of the weight cords snapping and the weights crashing on the floor. Furthermore, there is a piece of metal hardware attached to the stair post near this area, which probably had some sort of operational/functional connection to the weights. A piece of sheet metal now covers the opening of the former shaft. The paint is peeling around this cover, revealing green paint underneath the white layers. The ceiling is finished with 2-1/4" beaded boards which run north-south, and are coated with several layers of paint.

The second floor of the tower has a door at the south wall leading into the keeper's bedroom, Room 205. There is a significant horizontal crack in the plaster along the south wall, which extends through the southwest corner to window 2-9 on the west elevation. The paint is peeling below window 2-9, indicating evidence of moisture content in the wall beyond, however, there is no indication of significant water damage yet. There is also a stress crack extending from the window stool southward. The shoe mold along the east wall is extremely weathered, with only traces of the finish remaining. The wood appears to be very dry. The ceiling at this level has 2-1/2" beaded board finish running north-south, and is coated with several layers of white paint. The opening in the ceiling, which served as part of the weight shaft, is covered with a thin metal plate nailed to the ceiling. Another thin metal plate covers an additional opening that was likely the opening through which the electric conduit serving the lantern was located. The floor boards at this level are 2-1/4" boards that are laid in an east-west direction. There are markings

on the floor boards, indicating the ghosted outline of the enclosure of the weight shaft. The actual opening has been patched with plywood. The treads and wall stringer at the second floor level of the tower are extremely weathered and worn beneath window 2-9 to the point that most of their finish is gone.

The work room level of the tower has a window on both the north and south elevations. The windows have wood frames and single-light, double hung, wood sash. Both sashes appear to be new, as they have only a few layers of clear finish and contemporary hardware. The window openings have metal bars that are attached at the interior, which are malleable and insufficient as safety precautions. The window trim is identical to that found throughout the interior of the dwelling. The finish has weathered at both stools, exposing bare, dry wood. Non-historic, square balusters have been added to the formerly open handrail in this room as a guard for visitors (Illustration 14 of Part D). The balusters have a few coats of clear finish, much lighter than that of the adjacent historic wood. A wood ship's ladder extends up to the lantern room. The treads of the ladder and the surrounding floor boards are worn to the point that the bare wood is exposed, indicating this has been a high traffic area. The wood baseboard is uniformly weathered throughout the room, with little finish left. There is a large horizontal crack in the plaster approximately 3'-0" above the floor, which runs around the entire perimeter of the room. Furthermore, the ceiling is finished with 4-1/4" wide beaded tongue-and groove boards. The boards have a v-groove, which give the appearance of two beaded boards each, and are beginning to pull apart from each other.

The base of the lantern room is covered with a vertical board wainscot at the interior. The wainscot has been stripped of its finish, leaving remnants of white paint. The wood appears weathered and dry, is splitting in several areas, and appears to be retaining water along the bottom near the floor. The wainscot cap around the entire perimeter of the lantern is also extremely weathered and has experienced several areas of rot. The floor boards have several layers of red-brown, peeling paint. The paint build-up has obviously facilitated the separation of the paint from the wood, exposing the bare surface that is severely weathered, and appears to be wet often. The hatch door is missing, but there is a ghosted outline of the former hinges. The three brass ventilator caps are in excellent condition and appear to have been recently polished. Dave Snyder, Park Historian has pointed out that these are not original to the structure, but were donated to the park in 1989. One

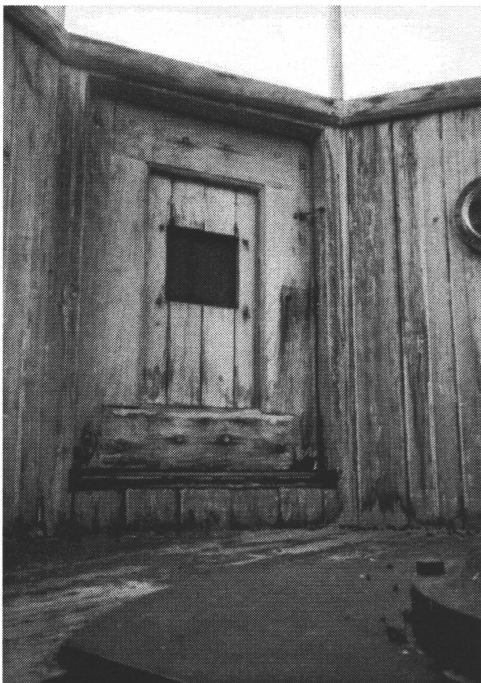
opening does not have a ventilator cap, it is a square-shaped opening with a metal frame which has completely rusted. There is a ghosted image of a former shelf along the north wall, exposing the gray primer. The small wood door providing access to the exterior deck is only a few feet in height, slightly shorter than the wainscot trim. It is severely weathered, and also shows evidence of dry rot both at the door itself and at the wood threshold, as seen in Illustration 32. The original hardware set is missing, however, there is simple hook-and-eye currently installed. The interior surface of the two metal panels at the lantern exterior has rusted, leaving only traces of white paint.

Interior Fabric Analysis

Basement

The entire ceiling surface of the basement, including that over the crawl space, is covered with rough, unpainted plaster. This plaster has failed and broken keys have led to the plaster completely falling off in several areas including: one large section in the basement area below the north one-story wing, one section at the east basement area around the cistern, and a large section in the southwest corner of the south crawl space. These

Illustration 32



Interior view of the lantern's exterior door and wainscot, 1995. Note the deteriorated wood.

areas are indicated on the Existing Conditions Drawings, at the end of this section.

At the area where the plaster is gone in the north section of the basement, the exposed ceiling joists and floor enclosure have been painted white. This suggests that the basement ceiling was painted and, therefore, that the space was occupied prior to the installation of plaster. Now that the entire basement ceiling has plaster, including the unoccupied crawl space, it is possible that this plaster was installed as either a form of fireproofing, if flammable materials were stored in the basement (in addition to in the brick oil house) or as insulation between the first floor and the unheated basement.

Openings

The interior wood trim of the lighthouse is a molded pilaster finish trim which is repeated at all of the openings. It consists of a thin wood pilaster rising from base blocks at the doors, and from stools at the windows, and meets the corner blocks at the head of either the door or window. The entire casing is tied together by a molded head casing, Illustration 33 shows this typical wood trim. This trim type is typical of the late 19th and early 20th century vernacular architecture. Most of the trim has excessive amounts of stain and varnish which have reacted chemically, producing an "alligatored" pattern.

Windows

All of the basement window openings have contemporary wood louvers, with four slats, providing basement ventilation. The original windows are still extant, and are held open behind the louvers with metal hooks attached to the basement ceiling.

All of the windows (except at the basement) appear to have either newer or refinished wood sashes, as they have minimal layers of finish and appear relatively undamaged. The original glass appears to have been salvaged and reglazed into either the new or refinished sash throughout the lighthouse.

Most of the windows throughout the lighthouse have the same pattern of nail holes on the corner blocks, indicating that the same window treatment hardware was used throughout the structure. The window stools throughout the structure are severely worn and weathered with little, if any, finish remaining. The wood appears to be very dry and has split at many of the open-

Illustration 33



View of the interior 5-panel wood door and molded pilaster finish trim which is typical throughout the lighthouse, 1995.

ings. Most of the window jambs are also weathered, especially along the west elevation, due to excessive wind and sun exposure. Also, the majority of the window sash cords throughout the dwelling and tower are frayed and broken, or are entirely missing.

All of the windows in the dwelling have contemporary window treatments, consisting of a dark green vinyl roller shade and white lace curtains. They were installed in 1983 by the National Park Service, based upon historic research and photographs.

Doors

All of the interior doors are five-panel wood doors (in a horizontal configuration as shown in Illustration 33), with two exceptions. The doors leading into each stairway are two-panel wood doors with glass top panels. The 5-panel door was popular in residential architecture from 1891 - 1940, suggesting that all of the original doors were replaced during the 1906 alterations, as there is no evidence of the style of the original 1862 doors. Currently, most of the wood trim throughout the lighthouse interior, including a majority of the doors, has an alligatored pattern of

build-up caused by the chemical reaction of the several layers of stain and varnish.

The base blocks at all of the doors are identical throughout the dwelling and tower. The trim is taller and has a different profile than the adjacent baseboard. The same trim that is used for the base blocks is used as an intermediate piece at all of the locations where a stair wall stringer meets the baseboard, as seen in Illustration 33. The baseboard throughout the dwelling and tower is a three member molded base, a typical mill profile of the early and mid 19th century, also shown in Illustration 34.

The interior door hardware sets are also the same throughout the lighthouse. They all have round knobs which are black, baked-on enamel. There are a few exceptions, such as locations where there are replacement parts and at the exterior doors. These are noted in the Door Schedule on the facing page. There are door stops attached to the wood baseboard throughout the dwelling to protect the walls. The door stops at the first floor are all turned wood and at the second floor they are decorative metal. All five of the exterior doors are of two-panel wood with top panel glass. The exterior surface is worn.

Illustration 34



View of the north wall of the south stair in the Keeper's Dwelling, 1995. Note the plinth detail, which is typical at all of the stairs in the dwelling, including those leading to the Tower, and the ghosting of a linoleum runner.

Door Schedule - Existing Conditions

Door Schedule			
Door No	Style	Hardware type / Condition	Condition
101.1	5-panel	A: black knob on rm. 101 side and brown "marbalized" on rm. 112 side	"Alligatored" finish.
101.2	2-panel; top glass	A: black knobs	casing cut away in two locations for non-historic locks; "alligatored" interior severe weathering at bottom rails and panel exterior; split in center of bottom panel;
101.3	5-panel	A: black knobs	Appears to have been refinished.
101.4	5-panel	A: black knobs	Appears to have been refinished.
102.1	2-panel; top glass	B: white porcelain knobs	Severely weathered exterior surface, panels split, bottom rail / stile joint separating interior casing is cut/damaged from non-historic locks
102.2	5-panel	A: black knobs	Appears wood has been stripped; new polyure
102.3	5-panel	A: black knobs	"Alligatored" finish.
102.4	5-panel	A: black knobs; missing 102 side	"Alligatored" finish.
104.1	5-panel	A: black knobs	"Alligatored" finish.
104.2	5-panel	A: black knobs	"Alligatored" finish.
105.1	5-panel	A: black knobs	"Alligatored" finish.
105.2	5-panel	A: black knobs	"Alligatored" finish.
105.3	5-panel	A: black knobs	"Alligatored" finish.
105.4	2-panel; top glass	A: black knobs	"Alligatored" finish.
106.1	2-panel; top glass	B: black knob on int. brown knob on ext	Casing cut/damaged from non-historic lock; btm. severely weathered esp. at exterior; stiles and rails pulling apart.
108.1	5-panel	A: black knobs	"Alligatored" finish.
108.2	5-panel	A: black knobs	"Alligatored" finish.
108.3	5-panel	A: brown "marbelized" knobs	"Alligatored" finish.
108.4	5-panel	A: black 108 side; missing 111 side	"Alligatored" finish.
109.1	2-panel; top glass	A: black knobs	"Alligatored" finish.
110.1	5-panel	A: black knobs	"Alligatored" finish.
110.2	5-panel	A: black 112 side; missing 110 side	"Alligatored" finish.
114.1	2-panel; top glass	B: black interior; brown exterior	Exterior surface of wood weathered, bottom panel starting to split.
115.1	2-panel; top glass	B: black interior; brown exterior	Exterior appears to have been stripped, new clear finish on exterior, dry splitting wood; rosette missing.
201.1	5-panel	A: black knobs; lock missing (tongue)	"Alligatored" finish.
201.2	5-panel	A: black knobs	"Alligatored" finish.
202.1	5-panel; transom	A: black knobs	"Alligatored" finish.
202.2	5-panel; transom	A: black knobs	"Alligatored" finish.
204.1	5-panel; transom	A: black knobs	"Alligatored" finish.
204.2	5-panel	A: black knobs	"Alligatored" finish.
204.3	5-panel	A: black 205 side; missing 204 side	"Alligatored" finish.
205.1	5-panel	A: black knobs	"Alligatored" finish.
205.2	5-panel	A: black knobs	
208.1	5-panel	A: black knobs	
209.1	5-panel	A: black knobs	
209.2	5-panel; transom	A: both knobs and core rod missing	
210.1	5-panel; transom	A: both knobs and core rod missing	
210.2	5-panel; transom	A: black knobs	
210.3	5-panel	A: both knobs and core rod missing	
Hardware Types:			
A: typical interior; brass locksets; all round knobs, most black enamel; others are brown "marbelized"; a few at exterior doors are white p			
B: typical exterior; A hardware with additional non-historic deadbolt locks installed; casing cut/damaged			

Stairs

There are two staircases between the first and second floors, one serving each half of the divided dwelling. These stairs are identical in material and design. Both are self-contained stairways that open to upper stair halls. The stairs were designed without handrails, however, there is a balustrade along the open floor at the upper stair hall with square balusters and a simple square newel post, as shown in Illustration 35. The handrail itself has a simple curved profile, appearing to be a stock mill item of the period. Currently, the south stair has a non-historic rounded wood handrail with metal brackets attached to the north wall of the stairway.

Keeper's Residence (South Half of Dwelling)

Without any significant evidence of large areas of overall replacement, the majority of the plaster throughout the lighthouse likely dates to the 1906 construction episode. This will be further examined in the room specific conditions that follow which discuss floor, ceiling, and wall finishes, (and plaster conditions in particular).

First Floor

Room 102, Keeper's Kitchen

Floor: The floor consists of 3-1/4" maple tongue-and-groove boards laid in a north-south direction. There is a buildup of varnish on the boards and a distinctive rectangular marking at the perimeter of the room, denoting the previous location of a piece of linoleum or canvas. There is also a rectangular area, approximately 3' x 5' between the chimney and the sink which is lighter in color, appearing to have less layers of varnish. This most likely indicates the location of the stove pad, as the floor would have been stained and varnished around the pad since the stove was too difficult and burdensome to move every time. There are a few areas where the floor has been stripped, possibly testing for proper stripping throughout the room. At the time of field investigation bird droppings and dirt covered the floor, especially below the windows.

Ceiling: The ceiling of the room is plaster which has several hairline cracks across its entire surface. A more extensive indication of failure is a large crack extending the full length of the room running east-west, approxi-

Illustration 35

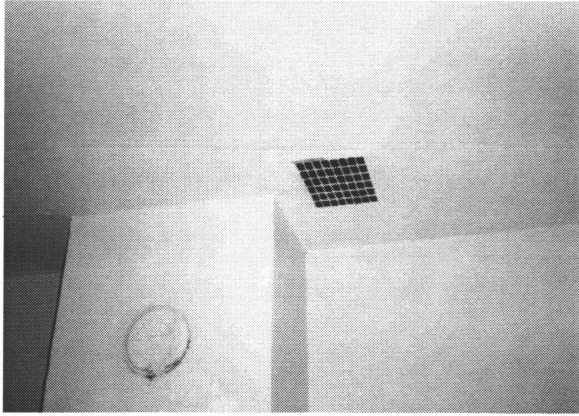


Photo of the handrail and balustrade at the top of the stair at the north half of the dwelling (Room 213, Stair Hall), 1995. Note the simple profiles including: the square newel post with a simple cap, the square balusters, and the curved handrail.

mately at the center of the room. It appears to have been caused by the deflection of the wood joists above.

Walls: All of the wall surfaces in the room have a 1-1/8" vertical wood bead board wainscot, extending 3'-11" above the finished floor with a simple profile wood cap. The wainscot is coated with several layers of white paint, which in some locations, appears to be close to 1/8" thick. This excessive buildup has caused paint failure. The wainscot cap is stained and varnished, and has white paint splatter from the walls along most of its surfaces. A wood quarter-round shoe mold is attached over the bottom of the wainscot, and is also painted white. This shoe mold is missing the entire length of the east wall, around the chimney at the south wall, and (a small piece) between the two doors on the west wall. The gray primer is exposed on the wainscot in the areas where the shoe mold is missing. There are also several nail holes in the wainscot just south of door 102.1 on the east wall, and is probably the location where coats used to be hung. All of the wall surfaces above the wainscot are plaster. Evidence of water infiltration at the chimney includes: peeling paint, spalling plaster, and rust around the metal stove pipe hole cover, as seen in Illustration 36.

Illustration 36



View of the chimney and north wall of Room 102 (Kitchen), 1995. Note the evidence of water infiltration at the chimney including: the spalling plaster, peeling paint, and rust around the metal stovepipe hole cover. Also note the metal grille at the opening, cut in 1931 by Keeper Wilkes to allow warm air upstairs.

Room 103, Pantry

Floor: Like Room 102, this room has the same 3-1/4" maple boards running in a north-south direction. There is a butt joint at the threshold of Door 102.2, between Rooms 102 and 103, but there appears to be no evidence of a former saddle or any other type of threshold trim. The floor boards continue uninterrupted into the dining room, Room 104.

Ceiling: The plaster ceiling has experienced hairline cracking across its entire surface. The room is divided into two spaces connected by a wood cased opening. There is a small gouge in the ceiling plaster east of the opening at the north wall. There is also a large crack, which extends the full width of the space running north-south, west of the opening.

Walls: There is extensive hairline cracking in the plaster at all of the wall surfaces. There is a large gouge in the plaster at the north wall just east of door 102.2 near the door head. Also, there are patches in the plaster from previous nail holes on the west wall. The plaster on the south wall around the stool of window 1-2 is spalling and the paint is peeling, suggesting water infiltration due to the lack of flashing at the exterior sill.

The east wall has four wood shelves, 11-1/2" deep x 3/4" thick, that extend the full width of the pantry. The top shelf appears to date to a later period than the other shelves as it has a lighter color stain finish, and the wall support is

a flat board. The other shelves have beaded board wall supports.

Room 104, Dining Room

Floor: As mentioned in the discussion of Room 103, the floor boards are continuous between these two rooms, consisting of 3-1/4" tongue-and-groove maple boards laid in a north-south direction. There is a distinctive line at the threshold of door 104.2, indicating that the floor has been stripped of its finish in Room 104, but not in Room 103. The stripped floor appears to currently have one or two coats of clear finish, and shows no apparent signs of deterioration or damage.

Ceiling: The ceiling is covered with 12" x 12" acoustic ceiling tiles that appear to be directly adhered to the plaster with a non-historic cove molding applied over them at the ceiling's perimeter.

Walls: All of the wall surfaces in the room have been covered with a non-historic wood paneling from the top of the baseboard to the ceiling. The historic wood window stools have been crudely cut to allow the installation of the paneling between them and the plaster surface. The paneling is starting to pull loose from the plaster below the window openings, suggesting the high moisture content of the wall. Below window #1-5, this condition is particularly bad, as the panel is pulling the top two layers of plaster loose. A few sections of the baseboard along the north wall have been stripped of finish, and the wood appears dry and weathered.

Room 105, Parlor

Floor: The floor in this room also has 3-1/4" maple boards running north-south. Since the floor boards are all identical throughout the first floor, it is highly probable that the original 1863 floor boards were removed, and the extant maple flooring was installed throughout the entire structure at the first floor. The floor boards in Room 105 have been stripped and currently have a few layers of clear finish. Excessive bird droppings and dirt cover the floor, especially near the windows along the west wall.

Ceiling: The ceiling is covered with 12" x 12" acoustic ceiling tile that appears to be directly adhered to the plaster, as in Room 104, with the same non-historic cove molding applied around the perimeter of the ceiling. The plaster ceiling area west of the cased opening has not been covered with a non-historic finish. There are

large cracks in the plaster at all four corners of the ceiling space, with excessive spalling along the west wall. This damage seems to be the result of the lack of flashing at the intersection of the porch roof with the exterior wall surface directly above.

Walls: There are two brass brackets, one on each jamb of the cased opening, which formerly held the rod for the portieres. There is excessive cracking and spalling of the plaster both above and below windows 1-7 and 1-8, due to the lack of flashing at the intersection of the porch roof with the wall, and at the exterior window sills. Some areas of the wall have been patched with a plaster-compound which differs in color and texture from the original surface coat of plaster and is beginning to pull loose. The rest of the wall surfaces have hairline cracks throughout the room. Evidence of water infiltration at the chimney is seen at the north face of the chimney and on the south wall above door 104.1, including: spalling plaster, peeling paint, and a large rust ring where the stovepipe cover has been removed. The plaster below window #1-6 was also moist to the touch during physical investigation, suggesting excessive water infiltration, again a result of the lack of flashing at the window sill. The north wall has two vertical cracks spanning the full height of the room at, approximately, the third points of the room. This may have been caused by the weight and settlement of the stair attached to the opposite side of the wall. There are also stress cracks extending from both corners of the cased opening, but the head of the opening does not appear to sag.

Room 114, Entry Vestibule

Floor: The floor is identical to Room 105's floor, with no separating threshold.

Ceiling: The plaster at the southwest corner of the ceiling has excessive spalling due to water infiltration. In addition, a crack runs through the center of the space its entire width in an east-west direction.

Walls: The west wall has severe water damage near the ceiling, as evidenced by the excessive spalling and cracking of the plaster above the door. The north, west, and east walls appear to have experienced only minimal hairline surface cracking due to normal seasonal temperature changes.

Room 113, Closet

Floor: The floor is identical to Room 105's floor, however, there is a distinctive line at the threshold showing that the floor boards have been stripped in Room 105, but not in Room 113.

Ceiling: The plaster at the ceiling has experienced only hairline surface cracks, again due to normal seasonal temperature changes.

Walls: There are a few significant diagonal stress cracks along the east wall extending from the floor to the ceiling, appearing to be a direct result of the weight of items previously stored on the shelves. These cracks have been patched with a patching compound that is now separating from the adjacent plaster surface. The plaster has completely failed along the north end of the west wall, and broken keys have let the plaster fall away exposing the wood lath. There is relatively little plaster damage at the north and south elevations, however, with stress cracks only extending from the shelves toward the west wall.

Room 117, Kitchen Closet/Small Pantry

Floor: The floor is identical to Room 102's floor.

Ceiling: There is a large section of the ceiling where the entire top layer of plaster has failed and fallen off. The remaining layers of plaster have several deep cracks.

Walls: The plaster is completely gone, exposing the wood lath at large portions of both the south and west walls. The historic wood shelves are intact and are coated with several layers of paint. There are also two wood drawers hung below the bottom shelf at the north end of the closet. The shelf brackets vary in size and style and from shelf to shelf. The contemporary storm windows are stored in this closet which have divided lights. Some discrepancy exists in the configuration of the historic storms. Some historic photographs suggest that the historic storms were single pane, however, the clarity of these photographs is questionable. Further investigation of this historic feature should be investigated.

Room 107, Stair Hall

Floor: The floor boards extend continuously through door 105.4 from Room 105.

Ceiling: There is a large stress crack extending from the open edge of the soffit back to the west wall. The weight of the bedroom wall above bearing down on this soffit has apparently caused this stress crack.

Walls: There are some horizontal and diagonal stress cracks along the north wall, radiating from, and most likely caused by, the weight of the stair. Overall, the other wall surfaces have only surface hairline cracking due to humidity and seasonal temperature changes.

Second Floor

Room 214, Central Stair Hall

Floor: The butt joint, where the 1862 and the 1906 floor boards meet, is visible near the east end of the stair hall. The floor boards west of this distinct "line" range from 5-1/2" to 5-3/4" in width and run north-south. Those floor boards east of the line are 4-1/2" wide and run east-west. The entire floor surface has been painted with several layers of gray paint, which is heavier along the walls, suggesting that several layers were applied around a historic floor covering. The stairs have stain and varnish buildup, creating a ghosted outline of an approximately 18" wide stair runner.

Ceiling: The only sign of plaster damage is the stress cracks which radiate from the central light fixture.

Walls: There is a large horizontal crack which extends around the outside face of closet 215, approximately 3 feet above the floor with vertical and diagonal cracks extending off of it. There are two vertical cracks which appear high in moisture content, both extending from the floor to the ceiling. One crack is along the casing of door 204.1 and the other is along the casing of door 205.1. There are two vertical settlement cracks along the north wall of the stair, extending from the stair treads to the ceiling, likely caused by the weight of the stair. Additionally, the surface plaster of the few inch wide space of the east wall, south of door 202.1, appears darker than the surrounding walls, and is weak and crumbling, suggesting that the plaster mixture used to patch this area contained too much sand.

Room 202, Southeast Bedroom

Floor: The floor is covered with several layers of gray paint, thicker and darker in color around the perimeter of the room, creating a ghosted image of the former linoleum or canvas floor covering.

Ceiling: The plaster ceiling has one large crack extending from the chimney across the room to the west wall. There is also spalling plaster and peeling paint alongside the east face of the chimney. Both of these conditions suggest excessive water infiltration at the chimney.

Walls: There is a horizontal crack in the plaster approximately five feet above the floor at both sides of the chimney on the north wall, suggesting lath movement behind them. This may have been caused by differential settlement between the frame walls and the brick chimney, the intersection of which the plaster spans continuously across. The non-historic porcelain sink is attached to the north wall with a plywood board for support and there are large unfinished openings in the wall system for the pipes which service the sink.

There are a few stress cracks extending from the window heads at windows 2.3 and 2.4. There are two vertical cracks extending from floor to ceiling at, approximately, the third points of the room on the south wall. The surfaces of all four of the walls have experienced considerable hairline cracking. Also, there is a stress crack in the plaster extending from the door head of door 202.2.

Room 215, Closet

Floor: The floor is identical to Room 202's floor.

Ceiling: There is one large crack in the plaster extending the full width of the closet in a north-south direction.

Walls: Overall the plaster walls are undamaged, with only a few surface hairline cracks and one vertical crack running the full height of the closet along the south wall.

Room 204, "Harold's Bedroom"

Floor: The butt joint of the 1862 and the 1906 floor boards is visible the entire width of the room. The floor surface has several layers of paint with more at the perimeter of the room, which appears darker in color, suggesting the ghosted outline image of a former rectangular linoleum floor covering.

Ceiling: There is evidence of high moisture content in the plaster along the sloped ceiling surface just west of and extending to the closet/east wall, including: peeling paint, spalling, cracking, and deteriorating plaster. There are also five stress cracks which radiate from the central light fixture, each extending to a wall and down to the head of each opening in the room.

Walls: There is a stress crack extending from the door head of door 204.2 to the ceiling at the east wall. There are also stress cracks extending from the window stools to the baseboard and from the head to the ceiling at windows 2-5 and 2-6. The plaster at the southwest corner of the room is spalling and cracking, which is the result of water infiltration at the chimney. In addition, physical investigation in the attic revealed that the roof sheathing directly above is also deteriorated. Small gouges in the plaster along the north wall have been patched with a patching compound which is beginning to break loose from the surrounding plaster surface. Additionally, there is a vertical crack, possibly structural, that extends the full height of the room about two feet south of Door 204.3.

Room 205, Southwest Bedroom

Floor: The extensive paint buildup on the floor boards throughout the room has facilitated the separation of the paint from the wood. This condition is accelerated beneath the windows, where most of the finish is entirely missing and the exposed wood appears dry and weathered.

Ceiling: There is one large crack in the ceiling plaster, which extends from the chimney corner to the corner of the tower. There are a few smaller cracks extending from the chimney to the window heads. These cracks all appear to be the result of water infiltration at the chimney.

Walls: There are stress cracks extending from the door heads of doors 204.3, 205.2 and 208.1, and from the window heads of windows 2-7 and 2-8. Both the walls and the

ceiling at the chimney (the southeast corner of room), are experiencing peeling paint, spalling plaster, and several cracks in the plaster.

Assistant Keepers' Residence (North Half of Residence)

Room 101, Kitchen

Ceiling: The plaster ceiling shows signs of moisture damage with random areas of peeling paint across the entire surface and additional stress cracks radiating from the central light fixture. There are also large holes cut through the plaster in the southeast corner of the room for the cold water piping leading to the second floor.

Floor: The 3-1/4" wood floor boards, which run north-south, are currently covered with a large piece of non-historic linoleum that is in poor condition. There are several holes cut through the floor system, both below and around the sink, in the southeast corner of the room for the cold water pipes. A large area of the floor, directly beneath the sink, has been replaced with non-historic floor boards that not only are a different size from, but are laid in a perpendicular direction to the original floor boards.

Walls: The plaster along the north face of the chimney has experienced excessive spalling and deterioration. This appears to be caused by continuous water infiltration, which is also indicated by the rusting of the metal stove-pipe hole cover. Also, along the south wall, there is a ghosted profile of the bottom of a sink on the wainscot around the existing ca. 1940s sink. The wood shoe molding is missing from the wainscot most of the length of the south wall. The missing shoe molding reveals gray paint on the surface of the bottom of the wainscot, which is probably the primer.

Room 108, Parlor

Floor: There is an area of damaged floor boards, approximately 16" in diameter. It appears that possibly either hot coals or candle wax was dropped here which burned the wood.

Walls: The south and west faces of the chimney have experienced severe deterioration due to water infiltration, including peeling paint and spalling plaster. The water is most likely entering at the roof flashing at the chimney, which has failed and is pulling away from the chimney's brick surface. In addition, the wood baseboard along the north wall has pulled away from the

plaster surface, yet another indication of the water/moisture content of the plaster. A large crack, spanning the full height of the wall at the chimney corner, suggests that the chimney has settled at a different rate than the adjacent wall.

There is also excessive peeling paint and spalling and cracking plaster both above and below windows 1-10 and 1-11. At the northwest corner of room, the plaster is powdery and falls off to the touch. Much of this plaster was wet during physical investigation.

There is a horizontal crack extending the full width of the south wall east of the cased jamb opening. There are three vertical cracks spanning the full height of the wall at the third points and a stress crack from each of the upper corners of door 108.1, both likely caused by the weight of the stair attached to the opposite face of the wall. The south wall also has several small gouges in the plaster which have been patched improperly.

The two brackets (one on each jamb of the cased opening), which previously held the rod for the portieres, are crudely cut wood, unlike the refined brass ones at the south half of the dwelling.

Room 109, Stair Hall

Floor: Although the flooring is continuous from Room 108, there is a distinct line in the finish at the threshold of door 108.3, indicating that Room 109 has been stripped, but not Room 108.

Ceiling: There are a few stress/settlement cracks extending from the open edge of the soffit back to the west wall.

Walls: The wood stair shows no sign of damage, and no evidence of the existence of a runner as at the south stair.

Room 110, Bedroom

Floor: The surface has a buildup of stain and varnish which has an alligatored pattern resulting from the negative chemical reaction of the different finishes, as is evident at most of the interior woodwork. There are three different perimeter lines of changes in this finish indicating three different sizes of linoleum or similar floor covering throughout the history of room, as indicated in Existing Condition Drawing 2.

Ceiling: The plaster ceiling has experienced only minimal hairline cracking, and appears to be the ceiling in the best condition throughout the entire structure.

Walls: The plaster beneath windows 1-13 and 1-14 has excessive spalling and cracking suggesting water infiltration due to the lack of flashing at the exterior sills.

The plaster at the southwest corner of the room/north edge of the chimney, has experienced severe spalling and bubbling at the surface. There is a stress/settlement crack extending east, in a horizontal direction, from the northwest corner of the room to window 1-13. The plaster has been patched below window 1-13, however, the new plaster is experiencing the same failure. There are cracks along the north wall, severe stress cracks radiating off of the apron of window 1-15, horizontal cracks between the doors on the south wall.

Room 112, Pantry

Floor: The floor is identical to the one in Room 110, and continues through, uninterrupted, to the threshold of door 110.2. There is evidence of the same alligatored pattern visible on most of the varnished interior woodwork.

Ceiling: The ceiling shows no apparent water or other damage except for surface cracks, which radiate from the light fixture.

Walls: The plaster has experienced several full height vertical cracks throughout the room. There are three shelves supported on beaded boards nailed directly to the east wall. There is a change in paint color at what would be picture rail height, and there is a non-historic metal bracket above door 110.2, which may have held a smoke detector recently.

Second Floor

Room 213, Upper Stair Hall

Floor: The butt joint, created by the change in direction of the floor boards, is as evident here as it is across the entire width of the structure. Layers of paint reveal the ghosted outline of a former piece of linoleum that did not extend to the walls, however, there is no evidence of a stair runner as there was at the south stair.

Ceiling: There are a few stress cracks radiating from the central light fixture with one crack extending along the west elevation to the head of door 209.2.

Room 201, Second Assistant Keeper's Kitchen

Ceiling: The ceiling is covered with 12" x 12" acoustic ceiling tiles directly adhered to the plaster ceiling with furring strips. A non-historic cove molding has been attached at the ceiling's perimeter, as seen in Rooms 104 and 105. Due to this lowered ceiling height, at the door heads, the cove molding has been directly adhered to the wood surface.

Floor: The floor is covered with a large piece of non-historic multicolored linoleum which is pulling loose and falling apart.

Walls: The walls are covered with non-historic wood paneling directly adhered to the plaster. The paneling has pulled loose at a section of the east wall, pulling the top coat of plaster off with it. Also, a metal medicine cabinet with a mirror is hung above the sink on the south wall.

Room 212, Closet

Floor: The wood flooring is the same as Room 201, and runs continuously through the threshold between the rooms.

Ceiling: The plaster ceiling has experienced only hairline surface cracking due to normal humidity and seasonal temperature changes.

Walls: There are deep vertical cracks extending the entire height of the space in each corner of the closet which may suggest some underlying structural problems.

There is also evidence of water damage near the ceiling on the north wall, as seen by the spalling plaster and peeling paint. The closet has wood shelves that were probably installed to convert the closet into a food pantry when the surrounding room finally began to be used as a kitchen.

Room 210, Second Assistant Keeper's Bedroom

Floor: The butt joint in the floor boards is evident the entire width of the room. There are several layers of paint, but no ghosted images of linoleum. Also, there is a large indentation in the floor boards at the east end of the room, suggesting that there was once a heavy piece of furniture there.

Ceiling: There are hairline surface cracks around the ceiling surface, with larger cracks radiating from the central light fixture.

Walls: There is evidence of high moisture content along the entire west wall, with large areas across the entire surface of the west wall experiencing excessive spalling, particularly at the northwest corner of the room (which is the chimney) at the walls and ceiling. There is also water infiltration at the windows on the north wall, 2-11 and 2-12, as seen by the spalling beneath the window stools and the stress cracks extending from the bottom corners. There is a diagonal crack extending from where the sloped ceiling surface meets the east wall that extends horizontally around the southeast corner to door 2102.

Room 209, Second Assistant Keeper's Living Room

Floor: The 5-1/2" wide pine floor boards, which run north-south, are coated with several layers of paint. This paint buildup has caused the paint to fail and to loosen in large chunks in an alligatoring pattern. The floor boards are especially weathered, and are worn to the bare wood beneath windows 2-9 and 2-10. The remaining paint shows a ghosted image outline of the former linoleum floor covering.

Ceiling: The ceiling is covered with non-historic 12" x 12" acoustic ceiling tile. This appears to have been installed by adhering furring strips directly onto the

ceiling's plaster. There is also a non-historic cove molding, which is installed around the entire perimeter of the room, and is directly adhered onto the wood casing of the door heads due to the lower ceiling height.

Walls: All of the wall surfaces have been covered with a non-historic wood paneling extending from the baseboard to the ceiling. The paneling has been cut around the metal stovepipe hole cover. The baseboard is pulling away from the wall in the northeast corner at the chimney, suggesting water infiltration and damage.

Fog Signal Building (and Hoist Room)

Exterior

Roof: The roof is painted corrugated metal, and shows no signs of excessive deterioration or damage. National Park Service maintenance records state that the roof was last painted in 1979. A half-round gutter is attached to the end of the overhang around the entire perimeter of the building. There are four downspouts, two on the north and two on the south elevation. These all lead into a cast iron boots that each extend approximately 45" above grade. Cloth netting has been attached to the bottom face of the eaves to prohibit birds from nesting.

West Elevation: There is evidence of brick repair and tuckpointing at the bottom of the north corner of the elevation, which was probably part of the National Park Service work that was documented in 1979. The wood screen doors and the wood sash window are all showing signs of weathering. The wood shutters at the window opening are also weathered, and the wood is beginning to split along the grain. The metal exhaust pipes of the generator are still present and exposed along the exterior of the brick wall.

North Elevation: There are conspicuous areas of tuckpointing where the new mortar is incompatible in color with the original. Just east of the door opening there is an electrical feed which extends out of brick approximately 2'-0" above grade and then buried, most likely the original 1940s feed to the lighthouse. It is buried and is also seen where it comes up on tower face.

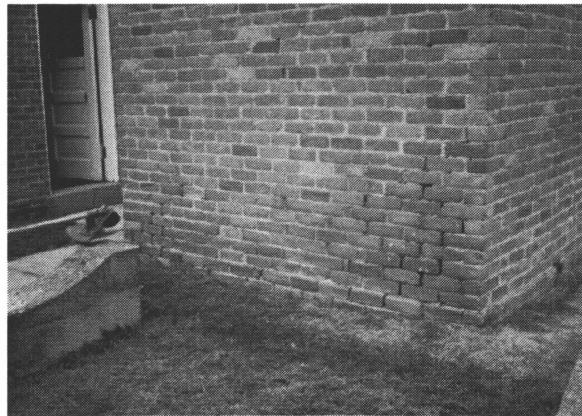
South Elevation: There is a six-light wood casement window with a wood frame and stone sill near the west end of the elevation. This window also has wood

shutters, which are painted dark green and showing signs of weathering.

Dormer: The exterior surfaces of the dormer walls have been covered with what appears to be stamped sheet metal painted the same red color as the corrugated metal roof. The openings on the east and west sides of the dormer, which formerly held the diaphone's horns, have also been covered over with this sheet metal. Four bolts on each elevation represent the approximate location of these openings. The south elevation has two four-over-four double-hung wood sash windows in wood frames that are painted white. The wood eaves, cornice, and corner boards are also wood and painted white.

Interior: The platform floor consists of 4" tongue-and-groove painted wood boards, their good condition suggests they may be replacements and newer than the 1932 installation of the raised platform to accommodate the air diaphone equipment. The upper walls and the entire ceiling in both the fog signal building proper and the winch room are covered with sheet metal. This sheet metal has experienced several areas of rust and peeling paint due to lack of maintenance.

Illustration 37



Detail of the deteriorated mortar joints at the south elevation of the brick oil house. (1995)

Brick Oil House

Mortar has broken loose creating open joints at the brick along the south elevation at the bottom east corner (Illustration 37). This is the only evident area in need of brick repair work on the structure. There was also no evidence of paint failure or damage at the sheet metal roof.

The interior of the brick oil house consists of the unfinished brick walls, the concrete floor is also unpainted, and the ceiling has been covered with sheet metal. During physical investigation there was one flammable metal storage cabinet stored inside, along with several packages of replacement stamped metal shingles. They are quite similar to the original lighthouse shingles.

Tramway

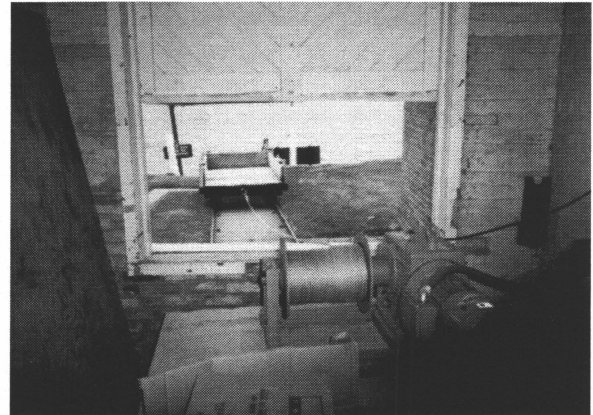
The tramway consists of 76 concrete steps from the edge of the bluff down to the boat dock. The concrete tramway appears to bear on grade from the top to approximately halfway down, with this portion experiencing areas of cracked concrete, and repetition of cracking every 9 to 12 treads (Illustration 38). The bottom section of the tramway is supported on a concrete bridging system and has experienced no noticeable concrete cracking or failure. All of the treads have broken or have worn

Illustration 38



Detail of the concrete tramway, displaying worn nosing and settlement cracks. (1995)

Illustration 39



View of the electrically powered winch, which currently operates the tram, 1995.

nosing, which is fairly typical for a concrete stair dating to 1931 that is exposed to harsh weather conditions. Overall, many areas of the tramway are covered with a yellow lichen which can be seen growing on most of the concrete surfaces of the site.

The metal tracks for the tram and the metal handrail both have extensive rusting, with runoff visible on the concrete surface.

Tram

The existing wood tram is operational and may date to 1932. An electrically powered winch, installed by the National Park Service, currently lowers and raises the tram up and down the tramway, as seen in Illustration 39.

Boathouse

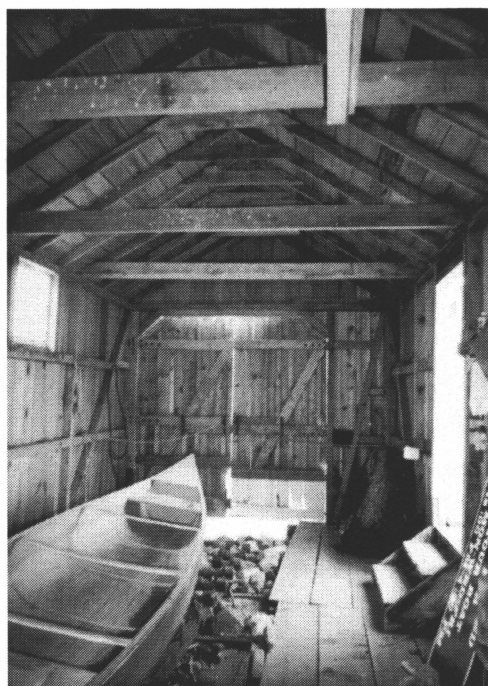
The boathouse consists of wood frame walls with board and batten wood siding, which are coated with are coated with several layers of white paint. The 2-3/4" wide battens are spaced approximately 5" apart. A rolled red asphalt roof was installed directly on top of the historic metal roof by the National Park Service in 1977 and was subsequently replaced in 1990. Historic documentation, including the 1910 *Description of Buildings, Premises, Equipment, Etc.* suggest that the metal shingles comprising the roof are similar to those comprising the roof on the lighthouse.

The boathouse has a concrete foundation-type wall supporting the north end of the building, which has a height of approximately 3'-0" to 4'-0" above the water

level. The concrete does not show any signs of deterioration, and appears to be structurally sound. National Park Service maintenance records indicate that unspecified repairs were made to the boathouse in 1977, and later, more specifically, to the exterior walls in 1981. The concrete foundation and slab supporting water pump at east end of building most likely date to the work undertaken by the National Park Service in 1977.

Due to the continuous exposure to water and moisture, much of the wood has rotted throughout the boathouse, including the replacement wood. The bottom boards of the south elevation are unpainted and appear fairly new, dating to work documented in 1981 (Illustration 40). A few boards on the north and west elevations have also been replaced. The west elevation has two large wood plank doors which swing outward allowing the boat to enter. The entire west elevation is experiencing rot and splitting due to the ebb and flow of the water, and continuous exposure to a variety of weather elements. At the time of investigation, the bottom of the doors was approximately 2' above the water surface. However, the bottom boards, up to approximately 2"-3" of the west elevation, were wet and most of the wood appeared to have excessively rot-

Illustration 40



Detail of the concrete tramway, displaying worn nosing and settlement cracks. (1995)

ted, indicating that the water level is frequently above the bottom of the door level. The marine rollers are intact and a boat was being stored here during physical investigation.

The boathouse has two windows. The window on the south elevation appears to have a fixed replacement window. The east window opening has been boarded up with plywood, and the window removed.

Dock

Although located in historic location and configuration, the current wood boat docks were constructed and are continually maintained by the National Park Service.

Asbestos Testing

A bulk asbestos analysis was undertaken by Braun Environmental Laboratories of Minneapolis in October of 1990, under a separate contract with Enviroscience, Inc., also of Minneapolis, Minnesota. Braun Environmental Laboratories analyzed nine bulk material samples (all samples being taken by Enviroscience, Inc. from areas at the interior of the lighthouse) for asbestos fiber content. The methodology of the analysis was in accordance with the Environmental Protection Agency's (EPA) method 40 CFR, Part 763, Ch. 1 (7-1-87 edition). Samples were examined for homogeneity. If any sample contained separate layered components, each layer was analyzed separately. No asbestos was reported to have been found in any of the nine samples that were analyzed.

Mortar Analysis

A mortar analysis and report were prepared in March of 1991 by David Arbogast, architectural conservator of Iowa City, Iowa, under a separate contract with the National Park Service, Midwest Regional Office. The mortar samples, however, were taken from the Raspberry Island Lighthouse by members of Enviroscience, Inc. The report states that the analysis was relatively difficult due to the small size of the samples taken, and the fact that none of the samples were placed in a simple mixture of sand and lime—the mixture that produces the most accurate results for this type of test. Most of the samples were placed in a mixture of sand, lime, and Portland cement, which is a mixture that often produces very inaccurate results.

These results were then compared to samples of typical mortar mixes by Fitzpatrick Structural Engineering (Refer to Appendix A). They found that, in general, the lime content in the samples greatly exceeds the portland cement content. The aggregate quantities are inconsistent; some of the samples exceed tolerances used today, resulting in relatively weak mortars. Others below this typical tolerance level are also relatively weak and susceptible to shrinkage cracking.

Paint Analysis

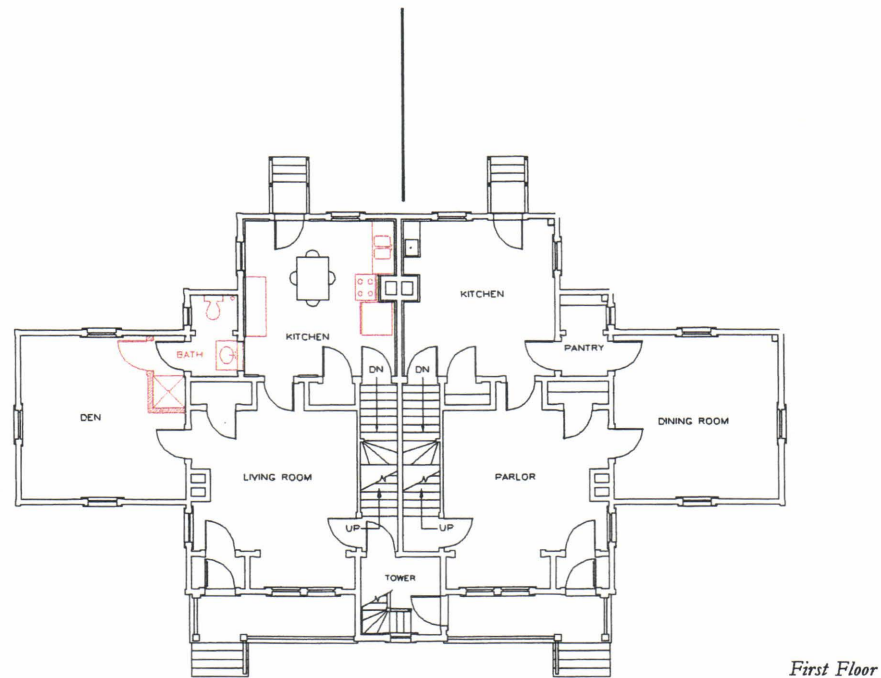
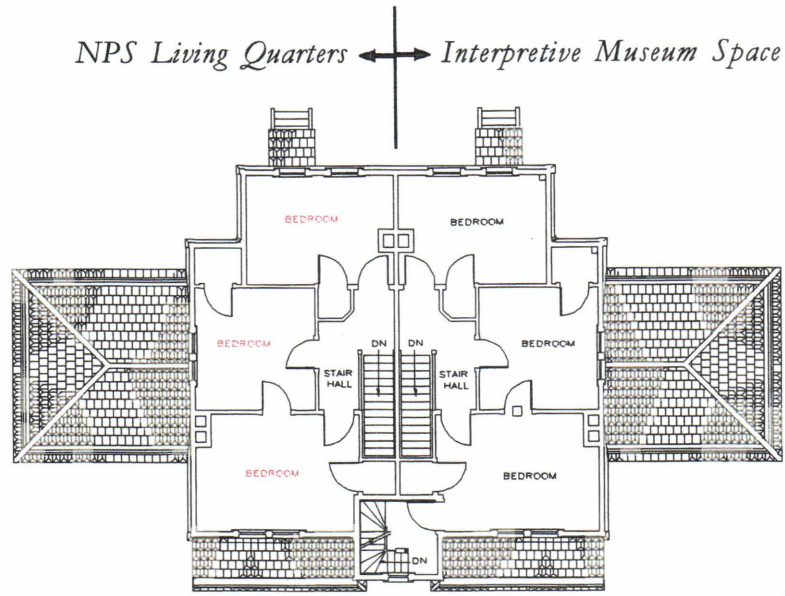
A paint analysis and report were also prepared by David Arbogast, architectural conservator, under a separate contract with the National Park Service, Midwest Regional Office. This effort was undertaken in January of 1991. Eighty-three paint samples were visually analyzed through an optical Olympus microscope and matched to the Munsell System of Color utilizing natural northern light. David Arbogast states that, "only opaque, pigmented layers (i.e. paint layers) were matched. It is impossible to color match finishes, such as metallic paints and leafs, and varnishes because their color is directly affected by their translucency and reflectance."³ He also notes that the overall quality of the samples was good, and, in virtually all cases, a complete analysis of each sample was undertaken. Several types of finishes were observed, including different paint types, varnishes, and a few metallic finishes.

The emphasis of the report was the revelation of the original finishes for all of the samples. A preliminary assessment of the original paint colors was presented by Enviroscience, Inc. Unfortunately, emphasis should be toward the period of 1914 - 1924 as described by the park. This is the period in which the park intends to interpret the interior of the dwelling. Therefore, further analysis of the paint samples should be undertaken with emphasis on the period of interpretation.

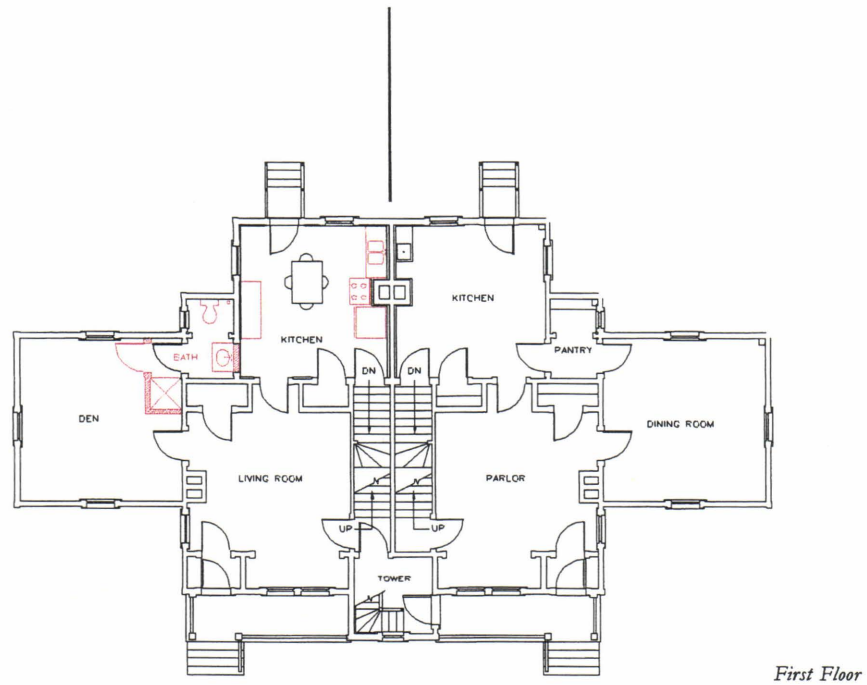
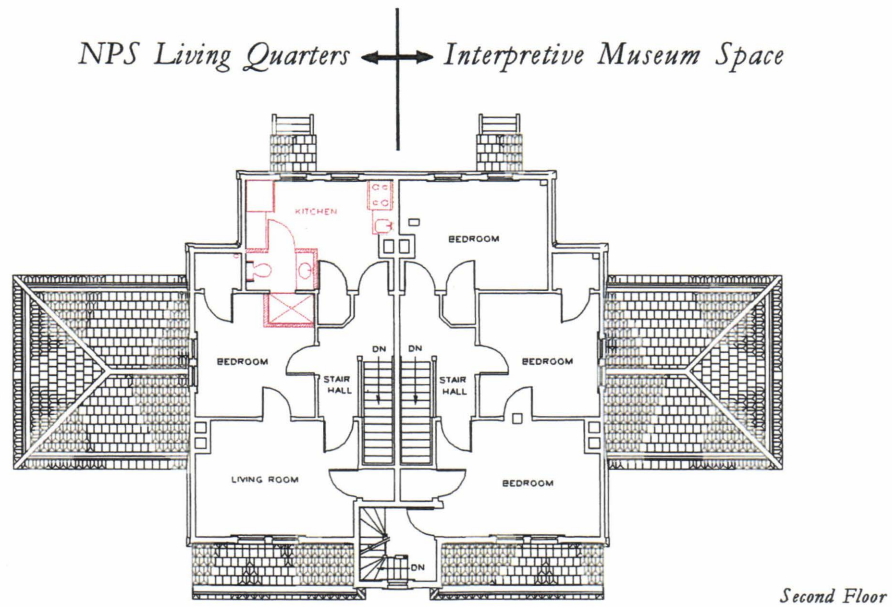
David Arbogast concluded that all of the original paint finishes appear to have contained linseed oil as their medium, with a semigloss finish. His conclusions were based, not only on the significant amount of data ascertained from the samples, but also on written and visual documentation relating to the history of the wall surfaces, such as when they were replastered and/or stripped of finishes.

Part G: *Design Recommendations*

Concept A



Concept B



Part G: Design Recommendations

Secretary of the Interior's Standards for Rehabilitation

Rehabilitation, as defined by the Secretary of the Interior's Standards for Rehabilitation, is the process of returning a property to a state of utility, through repair or alteration, which makes possible an efficient contemporary use while preserving those portions and features of the property which are significant to its historic, architectural, and cultural composition. The distinguishing historic qualities and character of the Raspberry Island Lighthouse will be preserved through the restoration of all existing exterior and interior historic fabric, where possible, and the reconstruction of missing elements as necessary. The south half of the lighthouse will be restored to serve as an interpretive museum space while the north half will undergo rehabilitation to serve as living quarters for National Park Service personnel. Plans and specifications for both halves of the lighthouse will be designed to have minimal impact on the structure's existing historic fabric.

General Approach toward Building and Site Recommendations

Building Interior:

South Half of the Dwelling and Tower

The historic fabric of the south half of the dwelling will be restored to its 1915-1920 appearance, as accurately as existing information permits. Modern systems, required for visitor safety and comfort, will be introduced in visually non-intrusive locations. This half of the dwelling will ultimately serve as an interpretive museum that focuses on the life of Keeper Benton and his family at Raspberry Island from 1915-1920. Included in the exhibit will be numerous artifacts and original furnishings of the Bentons' that are currently in the possession of the Apostle Islands National Lakeshore. This will provide an "on-site experience which focuses sharply on a particular family at a particular time and place in the Apostle Islands story."¹

Building Interior Alternatives:

North Half of the Dwelling

The north half of the dwelling will be rehabilitated to serve as living quarters for National Park Service personnel, in accordance with Number 9 of the Secretary of the Interior's Standards which states that, "Contemporary design for alterations and additions to existing properties shall not be discouraged when such alterations and additions do not destroy significant historical, architectural or cultural

material, and such design is compatible with the size, scale, color, material, and character of the property, neighborhood or environment."² Based on the decision to use the north half of the structure as living quarters, and in keeping with the Secretary of the Interior's Standards, two preliminary design concepts have been developed. Both concepts take advantage of the historical character of this particular half of the building while maintaining the original function of each of the rooms where feasible. The concepts also minimize, to the extent possible, the destruction of the historic fabric and the amount of new construction needed, following Number 10 of the Secretary of the Interior's Standards which states that, "Wherever possible, new additions or alterations to structures shall be done in such a manner that if such additions or alterations were to be removed in the future, the essential form and integrity of the structure would be unimpaired."³ Further, the concepts take into consideration the results of a National Park Service housing survey conducted in September 1988 of the agency's seasonal employees. The survey asked the employees to rank their privacy priorities and needs. According to the results, the employees ranked the sleeping area as their first priority; the toilet and sink area as their second; the shower and bathing area as their third; and, the kitchen area as their fourth.

Concept A: This concept proposes the utilization of the entire north half of the dwelling, both the first and second floors, as one large residence. The space could be used as either a single-family residence or as a dormitory for park personnel. The second floor would have three private bedrooms, while the first floor would have a shared kitchen, bathroom, living room, and den.

Analysis of Concept A: This concept would entail minimal changes to the historic fabric, such as the installation of contemporary utilities and fixtures to accommodate a contemporary kitchen and bathroom at the first floor. However, the original division and usage of the spaces would be altered. Originally, the north half of the dwelling was not meant to be used as a single residence (and was not built as such), but rather as two separate residences, one on each floor for each of the assistant keepers and their families. Concept A would convert these two residences into one, turning the kitchen at the second floor into a third bedroom.

While this concept incorporates the highest privacy priority of the Park Service's seasonal employees, which is the sleeping area, it provides little other privacy. Locating

the bathroom on the first floor would minimize changes to the historic fabric of the structure, however, it would also be inconvenient and less private for the people living there.

Concept B: This concept proposes the utilization of the entire north half of the dwelling, both the first and second floors, as two separate residences as it was originally built and used. Each floor would be a separate residence consisting of a kitchen, bathroom, living room, and bedroom.

Analysis of Concept B: Unlike Concept A, this concept basically maintains the original division and usage of the two floors. However, this concept would have a greater impact on the historic fabric of the structure than Concept A. This is primarily due to the installation of contemporary utilities and fixtures to accommodate a contemporary kitchen and bathroom not only on the first floor, but on the second floor as well.

This concept does meet all of the highest privacy priorities of the Park Service's seasonal employees. It provides comfortable and private living spaces, and also appears to be the most efficient use of the north half of the dwelling.

Building Exterior and Site Alternatives

Based on information obtained from documents, photographs, and archaeological research, as well as from physical investigation, two options are proposed for the exterior restoration of the lighthouse. Included in each option is the Park Service's preference to restore the building to its appearance during the period 1915-1920, as suggested in the scope of work.

Option No. 1: This option proposes to restore the entire station (both the individual structures and the site) to the period 1914-1924. This would allow consistent interpretation not only of the interior and exterior of the lighthouse, but also of the surrounding site, the gardens of which have already been reconstructed to represent this period.

Option No. 2: This option proposes the preservation of the exterior of the building and the site primarily as they exist today, which have remained essentially unchanged from the early-mid 1930s. This option, reflecting the period of 1915-1941, would encompass many of the historically significant elements that were added to the building's exterior, and to the site after 1920, while restoring the interior of the south half of the lighthouse to the

period of 1914 - 1924 to take advantage of the vast amount of artifacts from that period. Exterior elements that would be preserved to represent their appearance from the mid 1930 through the present would include:

1. The Porch Screens

The porch screens were originally built by Keeper Wilks in 1931, and were used every year following their construction. The framing, as well as the screens themselves, still exist and are in relatively good condition. The screens have been carefully stored in the wood shed and could be reinstalled to tell the complete story of the lighthouse. The Secretary of the Interior's Standards regarding porches states that "...they can be extremely important in defining the overall historic character of a building. Their retention, protection, and repair should always be carefully considered when planning rehabilitation work."⁴ Further, the housing survey conducted by the National Park Service in September 1988 of its seasonal employees, found that the screened porch was the most favored outdoor living area, particularly because of the prevalence of flies and other insects on the island. Restoring and re-installing the screens then would not only take into consideration the preferences of the Park Service's employees who will be living there, but also maintain an historic element at the same time.

2. The Gardens

The historical gardens, which exist today, were rehabilitated by the National Park Service in the late 1980s to reflect the period 1915-1920. However, this is not justification for restoring the rest of the site and the structure to that period. A photograph taken in 1936 shows that several areas of the 1915-1920 garden were still in existence. Also, as was previously mentioned, several significant historical elements were added to the structure in the 1930s. Therefore, if it is decided to restore the site and structure to reflect the period of the 1930s, the restoration work already completed on the gardens would still be in compliance with this later period.

3. The Concrete Tramway and Sidewalks

The concrete tramway and sidewalks were constructed in 1931. They are historically significant and functional features of the site, and are completely intact and usable (as this report is being written).

Option 2 also corresponds to the objectives set forth in the "Interpretive Prospectus" of 1979, and to the "Historic Furnishings Study" of 1989, which calls for the

interpretation of Raspberry Island to correspond with and compliment other local sites and museums in the region. The principal objective in refurbishing the keeper's quarters and the fog signal building, as proposed in the "Interpretive Prospectus," is to "help visitors visualize and understand how a light station functioned in the days before radio and other electronic aids to navigation and how keepers and their families coped in their relative isolation from the mainland. To this end it is proposed that the equipment in the light tower and the fog signal building be restored as nearly as possible to its appearance in the early 1930s, when the 5th-order light operated with kerosene, and a clockwork revolving mechanism and the fog signal was a compressed air diaphone horn."⁵

Overall, Option 2 provides a more comprehensive understanding and interpretation of the site, and its evolution relative to changing technology. Furthermore, utilizing Option 2 will not conflict with the interior restoration and garden reconstruction to the period of 1915- 1920 already completed, but instead will compliment it, and allow for broader interpretation of the site.

Recommended Treatments

Site Specific

Some site rehabilitation has already been undertaken by the National Park Service. Garden plots have been reconstructed around the lighthouse based on historic photographs dating to the period in which Lee E. Benton was keeper, which was from 1914 to 1924. Otherwise, National Park Service intervention at the site has been limited to the maintenance and stabilization of existing features in their current conditions. The area outside of the immediate site plateau has continued to overgrow with vegetation, with only the historic inner boundary kept as a cut, sharp line.

Only the immediate historic plateau surrounding the structures can feasibly be restored or preserved to its appearance in the early-mid 1930s. The outer area of the site has returned to natural growth, and its restoration is not recommended for both economic and maintenance reasons. However, the option of restoring some or all of the original clearing is presently being considered in a separate park plan. In addition, the erosion that has taken place at the bluff is virtually irreversible. The bluff should be stabilized to prevent further erosion.

It is recommended that the site be restored and preserved to its appearance during the 1930s. This would require minimal physical change, since there have been limited changes to the site since that time. The gardens that were plotted by Keeper Benton (or significant remnants of them) were still in existence in the 1930s, as evidenced by historic photographs, so restoring the site to the 1930s would not conflict or ignore this important site characteristic. Further, restoring the site to the 1930s would allow for a broader interpretation of the evolution of the site. Additionally, the possibility also exists that future research will dictate a change in how the gardens are presently laid out.

Building Exterior

Based on information obtained from historic documents and photographic research, as well as from physical investigation, the following treatment recommendations are proposed for the preservation, architectural restoration, and the contemporary use of the Raspberry Island Lighthouse. These recommendations are based on the assumption that the exterior will be restored in accordance with Option 2 above (circa. late 1930s which falls within Site Episode 3, 1906 - 1947), which will require the least amount of site work, and will primarily consist of "as is" preservation of the site.

Roof: There are two alternative approaches for the treatment of the lighthouse roof. Alternative No. 1 is a short-term approach which will attempt to prolong the life of the existing stamped sheet metal shingles. Alternative No. 2 provides recommendations which should be considered as part of a comprehensive, long-term restoration program.

Regardless of which alternative is undertaken, there are several issues that must be addressed. All areas of the deteriorated wood sheathing need to be located and repaired. One known area of severe damage is adjacent to the south chimney. Shingles at the area(s) of deterioration must also be removed. (If Alternative No. 1 is selected, however, care should be taken to minimize the number of shingles removed, and the way in which they are handled and stored.) New sheathing should be installed to replace any deteriorated wood. At most areas of the roof where there are intersections, particularly at the porch roofs and at the chimneys, the lack of flashing has caused severe water damage to the interior of the structure. The shingles at these areas should be removed, and proper metal flashing installed. Following the sheathing replacement and

flashing installation, either the existing shingles, or new ones that are identical to the old, should be reinstalled. Whichever alternative is undertaken, a cyclical maintenance program should be written and followed.

Alternative No. 1: This alternative consists of the general repair of the existing shingles, and is a short-term solution. It involves the following steps:

1. Removal of all loose paint and scaling rust with a gentle wire brush and hand-scraping.
2. Individual holes should be repaired with mastic compound or metal patches.
3. Application of a rust-inhibitive primer immediately after the completion of steps 1 and 2.
4. Application of the paint, with the color selected according to the paint analysis.

Due to the temporal nature of this alternative, it is not considered attractive to the Apostle Islands National Lakeshore in light of the financial and labor investment required and the imminent future deterioration.

Alternative No. 2: This alternative consists of treatments that provide for the long-term care of the roof. Given the age of the existing roof, the replacement of the entire roofing system is encouraged as part of a comprehensive preservation program. Prior to investment in interior treatments, especially the introduction of artifacts and historic furnishings, the entire roof should be replaced. There is significant evidence of oxidation taking place at the exposed surfaces of the shingles, and it is likely that the underside is also rusting. Comprehensive treatment of the roof should include the following steps:

1. Removal of the existing roof shingles, which should properly be disposed of off the site.
2. Installation of new shingles which match the old ones.
3. Application of a rust-inhibitive primer followed by the paint, with color selected according to the paint analysis.

Stovepipe extensions: The two metal stovepipe extensions, which are attached to both the north and the south chimneys, were first introduced shortly after 1920. The

north chimney extension appears to be a relatively recent replacement, although the top cover is missing. This extension should remain, and the missing cover replaced. Due to the extensive rust at the south extension, however, that stovepipe should be replaced. Both extensions should receive protective coatings to prevent further deterioration.

West Elevation Porches: The lack of flashing at the intersection of both the north and south porch roofs with the west elevation has caused extensive water infiltration into the wood frame structure, and extensive deterioration of the interior plaster. New metal flashing, compatible with the metal shingles, should be installed to alleviate this condition. A minimum of wood clapboard and metal shingles adjacent to the work areas should be removed in order to keep the disturbance of the historic fabric to a minimum. Following the removal of these adjacent materials, the damage to the wood framing needs to be confirmed and any deteriorated wood replaced. A new piece of galvanized sheet metal, fabricated to completely cover the intersection of the sloped roof surface and the vertical wall, should then be installed, followed by a galvanized metal edged trim under the metal shingles, counter-flashing, and, finally, the reinstallation of the wood clapboards and metal roof shingles.

Paint should be removed, down to the bare wood, from all of the wood surfaces at both porches, including the tongue-and-groove decks, columns, and balustrades. If the wood decking can remain securely attached to the substrate material, and a relatively flush surface maintained, then the decking may be retained and preserved. Paint removal should be followed by paint preparation, which will require sanding at some locations where there is excessive paint buildup. It is important to keep in mind that like the roof, the porch decks are highly susceptible to weathering, and that the prescribed treatment will only prolong its useful life for a short period. Eventual replacement of the entire porch system, including the substrate and any deteriorated or damaged framing members should be considered as part of a comprehensive restoration program. Cedar would be the most appropriate wood to use for its replacement.

The moldings at the top and bottom of the porch columns at both porches should be replaced with newly constructed replicas of the originals based on both physical investigation and historic detail drawings. The additional piece of trim at the top of the porch columns should be replicated to match the profile of the small piece remaining at the

south porch post against the wall. A new skirt board trim, to match what is assumed to be the original at the north face of the north porch stair (which should remain and be restored), should be constructed. All of the wood elements should be painted based on the paint analysis, and the porch screens reinstalled in either the existing historic wood frames or reconstructed wood frames.

East Elevation Porches: Both of the east porches have been reconstructed by the National Park Service, and show no sign of damage or deterioration with the exception of one piece of rotted wood deck at the north porch. This deteriorated piece of the deck should be replaced. Both porches should be repainted (and prepared appropriately beforehand), and otherwise be maintained in their current form.

General Exterior Wood Surfaces, Including Clapboard Siding and Trim: The existing paint should be removed from all of the wood surfaces down to the bare wood, sound paint, or primer. If either the primer or sound paint is left, the edges should be sanded smooth to feather with the adjacent bare wood. Any loose exterior wood work found should be reattached, and any deteriorated pieces removed and replaced. In the future, greater care and attention needs to be paid with respect to paint preparation of the wood clapboard. All visible residual paint buildup should be removed as these are the areas that are susceptible to paint failure caused by the loss of the bond with the wood surface. After application of the initial primer coat, all gouges and cracks in the wood surfaces should be filled and the edges sanded smooth, followed by the application of finish coats.

Foundation: Although some repointed areas are conspicuously incompatible in mortar color and joint profile, physical investigation revealed that most of these areas are currently sound, and thus do not require repointing. However, it is recommended that for any future repointing, such as that which is required at the corners of the east elevation where step cracking has occurred, extra care should be taken to use a new mortar that is compatible in color, texture, strength, and profile to the original mortar.

Windows - General Treatments: All exterior wood sills should be repaired and consolidated where damaged and/or deteriorated. Consolidation should be undertaken using a two-part epoxy process. The first application should involve the consolidation of the existing wood fiber and kill all organic growth such as mold and fungi. The second application should involve the infilling of all

weathered and/or damaged surfaces to build them back up to the original surface profile. Following consolidation, the wood should be sanded and painted.

Currently there is no flashing or drip detail at the heads or sills of any of the window openings. This has led to excessive water infiltration through the wood window framing and eventually the deterioration of interior finishes below the windows. It is recommended that, as part of a comprehensive restoration program, metal flashing be installed above all openings and through-wall flashing at all window sills.

Tower Exterior:

Gallery Deck: Both the design of the current (historic) guardrail and the exterior door size prove insufficient for visitor access to the exterior portion of the lantern deck. However this area can be easily and safely viewed from within the lantern. Furthermore, at the exposed areas of corrosion, an insulating material should be installed between the copper sheeting of the deck of the floor and the galvanized steel of the guardrail post bases.

Lantern: All metal surfaces of the lantern, including the base and the roof, should be scraped to bare metal or sound paint. The holes or damage encountered repaired before the lantern is primed and black paint applied.

Building Systems

Structural: Based upon physical investigation and historical precedent, two differing stress values were used to analyze load capacities within the keeper's dwelling. Included in Appendix A are the tables used to calculate all loading limits and related notation provided by Robert Darvas Associates, P.C. (RDA). The analysis undertaken by RDA concludes that the dwelling has much higher loading capacities than those reported in the HSR written by Enviroscience, Inc. for several reasons, including:

1. Eastern White Pine was the assumed species in Enviroscience's report, which is a worse case assumption, and does not appear to be justified. Physical investigation by Quinn Evans / Architects (QE/A) has led to the assumption that the wood is either pine or fir.
2. Enviroscience's preliminary analysis had assumed a very low, conservative grade wood. Physical investigation by QE/A, however, revealed very few knots, splits, or shakes in the

joist members, implying a very high grade, No. 1 appearance grade or better.

3. Enviroscience's preliminary report used contemporary grading rules, which are not representative for the wood used at the Raspberry Island Lighthouse. The lighthouse was constructed in the mid 1800s and added to in the early 1900s, meaning that it was constructed with "old growth" wood which is stronger than the current "new growth" grading rules.
4. Because the wood appears to be of a higher strength wood than assumed in previous report, it also appears to be well seasoned, and graded at a lower moisture content.
5. Several other factors were involved in determining load capacities in this report. These are more specifically listed in Appendix A at the end of this document.

Stress Value A: This represents the higher stress value, justified by its age, of 1700 psi, assuming a wood, such as southern (yellow) pine, Douglas fir, or a similar wood. It should be noted that further research would need to be undertaken to identify the actual type of wood in order to assume this high stress value. This higher value gives a limiting live load at the first floor of 75 psf, and 32 psf at the second floor.

Stress Value B: This represents the lower value run, 1300 psi, assuming that the wood is Norway pine or another type of similar wood. This value gives a limiting load of 75 psf at the first floor, and a limit of 34 psf at the second floor. However, a value of 40 psf at the second floor could be obtained provided that some minor plaster cracking is acceptable.

Effects of Stress Values On the Rehabilitation Of the North Half Of the Dwelling As Living Quarters

Both psf limits are adequate for living and bedroom space at the first floor, as determined by the standard building code, (BOCA). BOCA requires a minimum of 30 psf for sleeping areas, with a minimum at the second floor of either 32 or 34 psf. However, if *Concept B* (providing an entire separate residence at each floor level) is undertaken, there will also be a living space at the second floor. The 32 psf will prove sufficient for limited occupancy and low intensity of use, as would be the case at this remote and seasonal location. In addition,

40 psf of live load may be achieved, but may cause minor surface cracking of the ceiling plaster directly below in the living room on the first floor. Therefore, the ceiling of the room directly below should be monitored for evidence of any deflection cracks. If they become evident, further study should be undertaken to change the intensity and use of the second floor living space.

Effects of Stress Values on the Restoration of the South Half of the Dwelling as an Interpretive Museum/Exhibit Space

Even though it is slightly lower than the required assembly live load minimum of 100 psf, 75 psf would prove sufficient for this particular structure. The number of persons occupying this portion of the building will continuously be monitored and limited. A slightly larger loading capacity (up to 100 psf) may be achieved, but at the expense of minor plaster cracking in the plaster ceiling directly below in the unoccupied basement and crawl spaces. The second floor loading limit of 32 psf poses more of a problem for public interpretative space. There are two options :

1. Provide additional structural members to increase the live load capacity. This is not recommended, however, due to the extensive impact it would have on the extant historic fabric.
2. Limit the number of persons accessing the second floor at the same time. Currently the park limits the number of persons in the tower at one time to five while other individuals wait in the southwest bedroom just outside of tower, thus increasing the live load in this room. Following restorative treatments, it is recommended that the number of persons in each guided tour remain limited to five. Each tour would begin at the rear (east) entrance of the dwelling, as outlined in the *Historic Furnishings Study*. A second group of five would not enter the dwelling until the first group reaches the second floor, thus the loading will never be greater than six persons per floor at a time. This limit may be increased to eight or ten, as determined by site interpreter, if it does not impede visitor comfort and safety in the tower.

The operating plan presented in the "Historic Furnishings Study" states that all tours will be on a guided tour basis only. Additionally, there would be, "Modern runners [which would] define the visitor's path through each room and protect the floors and floor coverings."⁶ The diagrams, which supplement the proposed path of interpretation, suggest that at the second floor, visitors would follow a direct path from the stairs through the stair hall (looking into, but not entering the middle bedroom), and along the north side of the northwest bedroom to the tower. This directed traffic pattern, together with the accompaniment of Park Service personnel, will prevent any unnecessary loitering of individuals in any specific location at the second floor, thus, decreasing the amount of the cumulative live load.

As determined by previous visitor comments, climbing the light tower to get a panoramic view of surrounding Lake Superior is the focal point/highlight for many of the visitors to the lighthouse. The tower stair is the main limiting factor in terms of the number of individuals occupying the tower at the same time. The stair treads are only 27" wide, and there are three winders at every flight; therefore two-way traffic is not feasible or safe. By maintaining the current limit of five persons, accompanied by an interpreter, in the tower at any one time, it may be assumed that there will continue to be one-way traffic both up and down the stairs. This will limit the loading on each flight.

Mechanical and Electrical Systems

Storm Water and Site Drainage: The interceptor ditch, which runs along the east edge of the site and drains at the bluff's edge north of the site, appears to have significantly reduced the amount of erosion immediately in front of the historic plateau area of the site. However, the outlet of this ditch appears to have, at the same time, created a new erosion swale north of the site. It is recommended that a more intensive engineering study be undertaken regarding bluff stabilization and site drainage. One particular area that should be investigated, in addition to the erosion swale north of the site, is the erosion swale immediately threatening the fog signal building. This swale has been created by the outlet of the drain which diverts overflow water from the fog signal building's underground cistern. The excess and speed of this erosion may pose a threat to the structural integrity of the structure quite soon.

Heating

General: It is recommended that the lighthouse be heated and ventilated, but not cooled. The heating system would adapt the original heating systems for contemporary use. The system should be designed to meet the minimum requirements for limited system use (primarily in the late evenings and early mornings at the early and late parts of the season). As the structure will be occupied by persons and museum artifacts only during the months of late May through October, all utilities, including heat, will be completely shut down during the winter months. As stated in the "Historic Furnishings Study," when "the station is closed in the late fall, furnishings vulnerable to extreme cold and dampness (chiefly organic materials) will be moved to a mainland storage facility."⁷

South Half of the Dwelling: Interpretive Museum Space: A propane-operated heating unit would be located in the basement. Heat would be distributed through the chimney, and the historic stovepipe openings would be adapted for heat flow into the first floor rooms. The two historic heat registers, in the flooring located at the second floor, could be adapted to distribute heat to the second floor. This adaptive system would provide sufficient heat for visitors and artifacts alike while, at the same time, creating the least amount of disturbance to the historic fabric of the structure.

North Half of the Dwelling: National Park Service Personnel Residence(s): Because this half of the structure would be lived in by Park Service personnel, a more sophisticated approach to the adaptation of the historic heating system would be required. The same approach of installing a propane-operated heating unit in the basement is recommended, with distribution to both the first and second floors achieved through the north and east chimneys. Historic stovepipe openings in the chimney faces should be utilized as much as possible to provide heat distribution into the rooms, and to limit the impact on the historic fabric of the structure.

Other alternative approaches for heating in the lighthouse, including electrical and solar power, are not advisable. The use of electrical heat would require the constant operation of a generator which would present a noise problem. Solar power would entail equipment that would be visually obtrusive to the site.

Site electricity

The need for electricity at the site is essential for occupancy of the island by park personnel, and for visitor comfort and safety. It is needed for a variety of reasons pertaining to the operation of the site, including: water for domestic purposes and the fire suppression system, hot water service, and lighting. The historic use, still in operation, of a generator and battery bank system, has met the minimal energy requirements of the island to date. However, three options are recommended in order to continue electrical production on the island and meet increased energy needs and demands:

Option 1: This option involves the continued utilization of the existing 15 kW generator, but installation of a new battery system with an AC inverter in the fog signal building. The generator appears to be large enough to accommodate the anticipated load, providing that the tramway winch and water pump motors are not started simultaneously (they may both operate simultaneously, however). The advantage of this option would be that it would require the least amount of money and physical change to the site. The downside would be that the fog signal building would continue to be used as a service building and, therefore, would not be able to be interpreted for visitors because of the noise and safety issues.

Option 2: This option, which is the recommended option, involves the relocation of the existing generator. The most desirable location would be in the one-and-one-half story warehouse. There is historic precedent for doing so as this building, until fairly recently (after the lighthouse was abandoned), was a utility structure. And, with the rehabilitation of the north half of the lighthouse as living quarters, this space would no longer be needed for residential purposes. Furthermore, the distraction of the generator would be kept from public view and safety, and the proximity of this location to the adjacent water tank would be ideal.

Option 3: This option, which is the most desirable option for economic, visual, and noise reasons, would involve utilization of wind power to create the required site electricity. It would require the construction of a windmill northwest of the historic site, or at another visually non-obtrusive location. An underground line would then run from the windmill to a battery bank installed in the one-and-one-half story warehouse. Again, an AC inverter is recommended. The size and placement of the windmill structure would need to be further investigated. This

method of producing electricity would have the least negative impact, visually, physically, and audibly on the historic site.

The existing 15 kW generator could also be relocated to the one-and-one-half story warehouse, as recommended in option 2, and be used as a backup system when necessary.

Electrical Service to the Lighthouse

The current 50 year old 15 kW system should be further examined in order to determine if it can sufficiently carry increased service to both the lighthouse and the fog signal building. The validity of all existing conduit should be also checked within the lighthouse. If it is acceptable then all conduit should be reused and both structures entirely rewired to UL standards and labeled.

Lighting System: New light fixtures, switches, and receptacles which are installed within both the lighthouse and the fog signal building, (because historic ones prove insufficient or unusable) should be installed in historic locations to the greatest extent possible. It is also recommended that further study be undertaken concerning lighting requirements for exhibits at the second floor of the south half of the dwelling. The "Historic Furnishings Study" recommended that natural daylight be utilized without any supplemental artificial light. This needs to be further investigated to determine what negative impact direct west sunlight might have on the artifacts.

All of the existing light fixtures are assumed to be the originals, dating to 1941. Those that are to remain should be structurally reinforced to prevent further plaster damage, and completely rewired to current Underwriters Laboratories, Inc. standards.

Security System: It is recommended that an intrusion detection system be installed with the least amount of destruction of historic fabric possible. This system would be utilized during the off-season, winter months, and be responded to by ranger staff within 30 minutes. However, it should be noted that Apostle Islands National Lakeshore personnel have stated that it is unlikely that support personnel will actually be able to respond to an intrusion alarm during the off-season, therefore questioning its need.

Water System

The current water tank located behind the one-and-one-half story warehouse has a 200 gallon capacity which provides adequate domestic water service for four persons occupying the lighthouse, based on average daily need. However, the tank needs to be pressurized and a hot water heater installed for hot water service. There are three options for achieving these requirements:

Option 1: This option, which is the recommended option for achieving both personnel and visitor comfort, involves the removal of the current elevated water tank, and the installation of a bladder tank in its place. The new tank would utilize the current 5 HP water pump. Adequate water pressure would be maintained, however, this option would require more frequent operation of the electrical generator.

Option 2: Although this is a less desirable option, it is both feasible and economical. It would involve the additional elevation of the current tank to create sufficient static head in order to serve the anticipated domestic use. This option would result in a higher first cost, and create a negative visual impact on the historic site.

Option 3: This is the least desirable option as it would involve the installation of solar panels to provide energy to pressurize the current water tank, i.e. in lieu of the use of the generator in Option 1, solar panels would be used. However, a large area of solar collection would be required for this task which would have a negative impact on the historic site and its interpretation.

It is assumed that if either Option 1 or 2 are undertaken, a propane fired hot water heater would be installed.

Gray Water Treatment

Due to the high content of heavy clay soil, a raised berm septic system is recommended. A location out of the path of visitor traffic, such as at north edge of site, would be the most desirable. A percolation test should be undertaken to verify the soil drainage capabilities to rule out the option of a flat drainage field. Following the installation of the raised berm, residents should be asked to keep the amount of food waste, especially oil, to minimum as this will quickly plug up the system.

Sanitary System

There are two options for providing sufficient sanitary waste disposal for either one or two residences at the north half of the dwelling.

Option 1: This option involves the installation of composting toilets at both floors, as currently utilized at Sand Island. This option is the least desirable primarily due to the inconvenience and the logistics (and sanitation) involved in emptying and transporting the waste outside, especially that generated at the second floor.

Option 2: This option is the most desirable. It involves the installation of two low volume flush toilets that would be connected to an underground storage tank for waste. This tank should be located within the reach of the pumping hose used by the National Park Service.

With either alternative, it is recommended that the vent stacks remain exposed and not buried in the wall system. If they were to be buried, the historic fabric would be destroyed. The location of the bathrooms at the east (rear) section of the north half of the dwelling allows the vent stacks to exit the roof at the rear of the building, creating limited visual impact on the site.

It is recommended that the existing public vault toilets remain in operation and maintained, as necessary, in their visually non-obtrusive location just south of the historic site.

Fire Protection

The "Management Policies" of the National Park Service states that, "when warranted by the significance of a historic structure or of the museum objects in a non-historic structure, adequate fire detection, warning, and suppression system will be installed. Fire-fighting personnel will be advised of any peculiarities or dangers inherent in a structure and any objects to be given priority for protection or rescue. Park personnel will receive training in fire prevention and suppression with hand-held extinguishers at historic structures and museums..."⁸ Therefore, it is recommended, due to the remote location of the lighthouse, that the entire structure be protected by a water sprinkler fire suppression system. The system's design should conform to NFPA Pamphlet #13 and #22. It is also recommended that this system be supplied by a hydropneumatic tank, which will have its own separate

line, but can be connected to the domestic water service pump. Additionally, Apostle Islands National Lakeshore staff state that a dedicated pressure tank could be supported by the existing generator in the event of extended fire fighting needs.

It is further recommended that a hose bibb be installed at an inconspicuous location at the lighthouse as long as water volume and pressure are adequate. Sufficient fire extinguishers and fire prevention manuals should also be located on site for the use of National Park Service personnel.

The fire alarm system should be installed in connection with a visitor intrusion alert system, which would be used in the off season months, allowing personnel the ability to reach the island within thirty minutes after being alerted. However, as with the intrusion alert system, it is important to acknowledge that personnel may not be able to reach the station during the off-season. Consequently, Apostle Islands National Lakeshore are concerned that fire protection may not be reliable if it is dependent upon support personnel responding during the off-season.

Lightning Protection

It is not known, or documented, whether or not the current lightning protection system was installed to meet the requirements of Underwriter Laboratories, Inc. A licensed installer/designer in this trade should further evaluate the system's existing condition, and determine what modifications are required to meet current UL standards.

Handicapped Accessibility

National Park Service guidelines state that, "The National Park Service will provide the highest feasible level of physical access for disabled persons to historic properties, consistent with the preservation of the properties' significant historical attributes... If it is determined that modification of particular features would destroy a property's significance, however, such modifications will not be made."⁹ In accordance with this guideline, it is only possible to provide handicapped accessibility to the first floor of the lighthouse. Providing access to the second floor, and to the light tower, is impractical from both an economic standpoint and in terms of preserving the building's architectural integrity. Also, the island does not have the electrical capacity to run an elevator, and it would not be practical to introduce an electrical system of that capacity to this remote location.

First floor accessibility would be achieved through the implementation of several minor measures. Access into the building itself from the rear is the most feasible. This location would not only entail the least amount of destruction to the historic fabric, by providing accessibility at the rear of the structure would also not be exclusive to handicapped individuals, since the *Historic Furnishings Report* has recommended that this be the main entry for all persons touring the lighthouse's interior. Accessibility into the rear entrance, directly into kitchen, would involve the construction of a ramp and alteration of the existing porch. Since this porch is a reconstructed version of the original (albeit a quite accurate reconstruction), any alterations to it would not be impacting the historic fabric. Once inside, the majority of the interior doors would have to remain open in order to provide sufficient clearance width for accessibility, and so that the historic hardware would not have to be removed.

With limited cost involved, handicapped accessibility is readily achievable at all of the outbuildings, and at the first floor of the lighthouse. Further study would be required to determine the ultimate use of each outbuilding, and whether or not they should even be open to the public.

The issue of actually accessing the island itself takes precedence over all of the smaller issues concerning accessibility and barriers created by individual elements of the site. The plateau, upon which the historic site is located, is approximately forty feet above the level of the boat docks where visitors approach the island. This is virtually the only means of approaching the island and getting to the site, with the exception of the sandspit which would require visitors to take a 3/4 mile path, upon landing, through rugged terrain to the historic site. Providing some form of stair lift at the existing concrete tramway would require a custom design solution for this particular site and tramway, and is not readily achievable both for economic and safety reasons. In addition, most standard U.S. building codes do not allow exterior open lifts.

The feasibility of providing access for persons with disabilities was addressed in great detail in the preliminary study undertaken by Envirosience, Inc. in 1992 which found that elevators were not readily achievable because of the much larger electrical output, and therefore the larger generator, required, the high operational and installation costs, the significant maintenance which could not be done by park personnel, and the visually intrusive impact on the site and destruction of the historic fabric.

Interior Finish Treatment Recommendations

General Finish Treatments for the Entire Dwelling

It is recommended, in accordance with the previously published *Historic Furnishings Report*, that all interior finishes at the south half of the dwelling, and the interior of the tower, be restored (or replicated if missing) to the historic period of 1914-1924. The approach this report takes is to retain as much of the historic fabric as possible throughout the entire structure, meaning the south half and north half of the dwelling and the tower. Some on-site determination of the feasibility of either maintaining the existing fabric or replacing it with replicas, will likely be required at the time treatment takes place, particularly at severe areas of surface damage and deterioration. It is suggested that, in cases where it is not feasible to remove the historic fabric without destroying it altogether, and it does not present a safety or structural hazard and or distract the interpretive experience, that the integrity of the material be maintained.

Interior Wood Surfaces: Interior wood surfaces include: window and door jambs, windows and doors, baseboard and shoe mold trim, and all wood components of the stairs. The majority of these interior wood surfaces throughout the dwelling, and the tower, are stained and varnished. The buildup and incompatibility of these finishes, however, has created a bubbling, or "alligatored" effect which needs to be removed. It is recommended that all wood in this condition be stripped using chemical finish removers, and then refinished.

Window Openings: Most window stools and some jambs have severely weathered surfaces, including some splitting. These surfaces should be sanded smooth and cracks filled with stainable wood filler. Some window openings have experienced very severe deterioration and may not be able to be completely sanded smooth. In this situation, if the opening can be feathered into the adjacent wood surface, and not be visually distracting, then this historic fabric should be retained. Furthermore, as part of a comprehensive restoration program, all window sash should be refinished, glazing putty replaced, weather-stripping installed, and sash cords replaced.

Wood flooring: Recommended floor finishes and coverings specific to the historic period of 1915-1920 are recommended in the *Historic Furnishings Study* and

should be followed. Prior to any physical work, the ghosted images of all former floor coverings should be accurately documented for archival records. All flooring, especially in areas of buildup and failure which have a historically natural finish, should be mechanically sanded to remove all finish. This should then be followed by application of an oil-based varnish. The use of polyurethane is discouraged due to the climatic factors of the structure. Varnish will wear more appropriately. Areas of the flooring that historically have had a paint finish should undergo paint preparation, including the mechanical sanding of uneven areas to remove paint buildup, and the feathering into smooth, adjacent areas. The floors should then have new paint applied according to the *Historic Furnishings Report*. Floor coverings should also be installed according to the recommendations in the *Historic Furnishings Report*.

South Half of Dwelling and Tower: Interpretive Exhibit Space

Room 102 - Kitchen: The wood wainscot and cap around the entire perimeter of the room should be stripped and refinished, according to the recommendations in the *Historic Furnishings Report*. The existing non-historic sink should be removed and disposed of properly, and a period 1915-1920 cast-iron sink with drain board should be installed in the historic location. The large ceiling crack, along with the hairline cracks at the ceiling, should be patched and repaired as necessary. Following exterior repairs to stop water infiltration, the damaged areas of the plaster at the chimney should be patched and repaired. Also, the missing shoe mold should be replaced at the locations where currently missing.

Room 103 - Pantry: The two gouges in the plaster east of the jamb opening, one in north wall and one in ceiling, should be patched and repaired. Furthermore, the damage at the plaster ceiling should be patched and repaired.

Room 104 - Dining Room: All of the non-historic acoustic ceiling tile, cove molding, and wood paneling should be removed with respect to the underlying historic fabric. Following removal, the damage caused by their removal should be assessed, along with other factors such as water infiltration. Any damaged plaster should be patched and repaired as necessary. The window stools were crudely cut along the wall during the installation of the panels. The missing portions should be reconstructed with same type of wood as the original, and the joints filled with stainable wood filler.

Room 105 - Parlor: All of the non-historic acoustic ceiling tile and cove molding should be removed with great care, in order to keep destruction of the underlying historic plaster to a minimum. Following removal, the damage should be assessed and the plaster patched and repaired as necessary.

Room 107 - Stair Hall: Although non-historic, it is recommended that the handrail attached to the north wall be reinforced and be kept in place for visitor safety and comfort. Because, historically, there was never a handrail there, it is recommended that a contemporary, yet complimentary, one be introduced rather than attempting to reconstruct a period element that has no precedence. The stress/settlement cracks along both walls should be repaired and monitored for future continued settlement. The cracks in the plaster ceiling should be patched and repaired.

Room 114 - Entry Vestibule: The exterior door, #114.1, especially at the bottom panel at the exterior surface, should be consolidated using a two-part epoxy system and repaired. Following the repairs, an exterior coating should be applied to prevent future excessive deterioration. The ceiling plaster cracks should also be patched and repaired following the determination of their cause.

Second Floor

Room 214 - Central Stair Hall: Further investigation should be undertaken to determine the extent of the settlement cracks along all of the walls in the stairwell, and to determine the possibility of reinforcing the stairs from below. All areas of damaged plaster should be patched and repaired.

Room 202 - Southeast Bedroom: Following exterior repairs to stop water infiltration, the damaged areas of plaster at the chimney, as well as other areas of plaster damage at the ceiling, should be patched and repaired. The non-historic sink at the north wall should be removed, and the wall and floor finishes patched and repaired as necessary.

Room 215 - Closet: Deteriorated areas of wall and ceiling plaster should be patched and repaired.

Room 204 - "Harold's Bedroom": Following the repairs to the chimney, especially the flashing, to stop water infiltration and further plaster deterioration, the plaster at the chimney and ceiling should be patched and repaired. All other areas of cracking and damaged plaster in the room,

caused by settling and mistreatment, should also be patch and repaired.

Room 205 - Southwest Bedroom: Following measures taken to prevent further water infiltration, including the replacement of deteriorated sheathing and flashing at the chimney, all areas of plaster damage should be patched and repaired.

Room 206 - Closet: The hatch providing access to the attic should remain intact for future maintenance. Repair and patch the deteriorated areas of wall and ceiling plaster, keeping the clothing hooks in place.

Tower

Lantern: The interior surface of the two metal panels, and the metal surface of the interior sill, should both be scraped and cleaned. This preparation should be followed with the application of a rust-inhibitive primer and finish paint, with the color selected according to the paint analysis. The wood surfaces, which have historically had a paint finish, including the wood wainscot and exterior door, should be repaired and consolidated using a two-part epoxy system, followed by application of new paint finish. The wood surfaces which have historically had a natural finish, including the wainscot cap and wood flooring, should be sanded smooth mechanically, and all cracks filled with stainable wood filler. This should be followed by the application of an oil-based varnish.

The historic shelving should be reconstructed per the *Historic Furnishings Study*, and linen curtains fabricated with historical accuracy.

Work Room: The non-historic bars should be removed from the windows, as the area of glass is too small to be considered a safety hazard in terms of building code. Areas of cracking plaster due to settlement at the wall and ceiling surfaces should be patched and repaired.

North Half of Dwelling: Living Quarters for National Park Service Personnel

Room 101 - Assistant Keeper's Kitchen: The existing non-historic linoleum should be removed. Considering historic accuracy, the non-historic locks from exterior door should also be removed and the wood jamb and casing repaired. However, according to the Apostle Islands National Lakeshore, the existing "Best Lock system" is considered to be relatively unobtrusive, offer great protection, and work better than the original skeletal lock system.

Following repairs to the chimney, especially the flashing, to stop water infiltration and further plaster deterioration, the plaster at the chimney and ceiling should be patched and repaired. All other areas of cracking and damaged plaster in the room, caused by settling and mistreatment, should also be patch and repaired.

Recommendations for contemporary kitchen: Wood base cabinets and new fixtures including: a sink, a refrigerator, and a stove should be installed, as indicated on the recommendations drawings in Part I of this report. Careful attention should be paid to keeping intervention/damage of the historic fabric to a minimum. Both the gas/oven and refrigerator will be propane-gas operated.

Room 108 - Assistant Keeper's Parlor: The area of the damaged floor with burn marks should be repaired by sanding mechanically. Attempt 100% removal; if not feasible diminish visual evidence as much as possible. If only a ghosted image remains, strip and refinish floor as outlined in general recommended treatments, since faint evidence of damage of historic fabric is more desirable than splicing in new wood members which will create visual distraction. Following exterior treatments to prevent further water infiltration, especially flashing at the chimney, windows, and porch roofs, areas of cracked and deteriorated plaster should be patched and repaired.

Room 109 - Stair Hall: Areas of plaster damage should be patched and repaired. The stairs should be treated according to the general finish treatments for all of the interior wood surfaces.

Room 110 - Bedroom: Areas of plaster damage, as indicated on existing conditions drawings, should be patched and repaired.

Room 112- Pantry: Areas of plaster damage, as indicated on existing conditions drawings, should be patched and

repaired. The non-historic hardware from above the door should be removed. This room will become part of the proposed contemporary bathroom.

Recommendations for contemporary bathroom: New wood stud walls, as shown on the recommendations drawing in Part I of this report, should be constructed. The bathroom fixtures, including a sink with attached base cabinets, a prefabricated shower unit, and a toilet with adjacent, exposed vent stack (enclosing it in the wall would destroy the historic fabric) should then be added. The introduction of this bathroom requires that door 101.1 be permanently sealed in a manner which is least destructive of historic fabric.

Second Floor

Room 213 - Upper Stair Hall: Areas of damaged plaster, as indicated on existing conditions drawings, should be patched and repaired.

Room 201 - Second Assistant Keeper's Kitchen: The non-historic acoustic ceiling tile and perimeter cove molding should be removed. After assessing the plaster damage caused from the application of these non-historic finishes, the plaster should be patched and repaired. The non-historic linoleum should be removed, and finished according to the general floor treatment recommendations for the north half of the dwelling. The non-historic wood paneling should be removed and, after assessing the plaster damage, the plaster should be patched and repaired. The painted cast-iron sink and medicine cabinet should be removed, and the finishes underneath, if damaged, should be patched and repaired. This room will be updated as a contemporary kitchen if Concept B is chosen.

Recommendations for contemporary kitchen: Wood base cabinets and new fixtures including: a sink, a refrigerator, and a stove should be installed, as indicated on the recommendations drawings in Part I of this report. Careful attention should be paid to keeping intervention/damage of the historic fabric to a minimum. Both the gas/oven and refrigerator will be propane-gas operated.

Room 212 - Closet (Pantry): All plaster damage should be patched and repaired following repairs made to stop water infiltration, (most likely caused by the deteriorated wood roof sheathing above). The wood shelves should be restored and refinished in order to maintain the historic use of this closet as a pantry.

Room 210 - Second Assistant Keeper's Bedroom: Following exterior treatment to prevent further water infiltration, including flashing at the windows and chimney, the areas of plaster deterioration caused as a result should be patched and repaired.

Recommendations for Fog Signal Building Treatments

As proposed by the *Historic Furnishings Report*, "Before or after their tour of the keeper's dwelling and light tower, visitors will have the opportunity to walk through the fog signal building..."¹⁰ Furthermore the Interpretive Prospectus for Apostle Islands National Lakeshore calls for the fog signal building to be "furnished with the total completion of period equipment that would have been in place during its operation."¹¹ Two entirely distinct sets of fog signal apparatuses were placed in the fog signal building throughout its operation from 1903 through 1947. However, both sets of equipment cannot be displayed in the building at the same time. As was previously mentioned in this report, the Apostle Islands National Lakeshore has determined that the 1930s should be the period of restoration for the site and the fog signal building. This would require, therefore, the reinstallation of the second set of apparatuses comprising the air diaphone system, which was in operation from 1931 - 1947. Further, the *Historic Furnishings Report* states that the, "retention of certain later equipment [later than the 1930s] (Kohler generator and Exide battery bank) will help visitors understand how technology changed in the 1930s and 1940s, shortly before automation brought the era of manned lighthouses to an end.

Exterior Treatments

All of the exterior wood surfaces should be restored, including the window frames, shutters, doors, storm doors, and the wood surfaces of the dormer. Restoration should include the removal of paint down to the bare wood, sand paint, or primer. If either the primer or sand paint is left, the edges should be sanded smooth to feather to the adjacent bare wood. A primer coat should then be applied, followed by finish coats, with colors selected according to the paint analysis. All of the wood windows should be also refinished, and the glazing putty replaced. All current features of the structure should be restored intact, including the structural reinforcement added in 1932. As stated in No. 4 of the Secretary of the Interior's Standards for Rehabilitation, "Changes which may have taken

place in the course of time are evidence of the history and development of a building, structure, or site and its environment. These changes may have acquired significance in their own right, and this significance shall be recognized and respected." One significant structural change, which should be fully restored at the fog signal building, is the raised platform and roof dormer. The sheet metal should be removed from the openings at the dormer prior to the reinstallation of the horns.

Interior Treatments

To restore the interior of this structure for visitor interpretation, all contemporary maintenance equipment and other debris should be removed from the structure and relocated to one of the unoccupied outbuildings. To eliminate noise level and potential safety hazards, the generator could also be relocated and continue to service electric power from one of the outbuildings. However, in accordance with the *Historic Furnishings Report* and the desire of the Apostle Island National Lakeshore, should remain within the Fog Signal Building, be properly secured, and all safety precautions taken to interpret as part of the history of the building.

All of the interior metal surfaces, including the platform, ladder, and handrail, should be scraped to bare metal and refinished. All of the interior concrete surfaces should be cleaned and painted, with the color selected according to the paint analysis. All furnishings (including the existing battery bank) should remain in the fog signal building, or be reinstalled elsewhere in accordance with the *Historic Furnishings Report*.

Part H:

Research Recommendations

Part H: Research Recommendations

Further archeological research should be undertaken at areas throughout the site to obtain possible cultural artifacts which may help to further understand the site chronology. Vague bits of information reveal the existence of former (temporary) structures and gardens built and removed by various keepers throughout the history of the Raspberry Island Light Station.

Furthermore, asbestos testing should be undertaken prior to demolition to check for asbestos content in adhesives of non-historic acoustic ceiling tile and paneling.

Additional investigation of the historic lighting system and fixtures in place along with the contemporary lighting needs of the park should be undertaken. This assist in developing a precise new lighting plan which may include the restoration of historic fixtures, the installation of contemporary fixtures, or combination of these.

Part I:
Preliminary Design

Preliminary Design

The preliminary design and treatment drawings included in this section are based on Concept B of Part G. Concept B requires the larger amount of new construction. The finish treatments recommended, including the door schedule, coincide with both concepts. Following review of 95% submission, drawings will be modified according to National Park Service comments.

Door Treatment Schedule

Door No.		Treatment(s) Required
FIRST FLOOR	101.2	Remove non-historic locks; patch and repair wood jamb and casing. Consolidate and repair bottom wood panel, rails, and stiles.
	102.1	Remove non-historic locks; patch and repair wood jamb and casing. Consolidate and repair bottom wood panel, rails, and stiles.
	102.4	Replace missing black enamel door knob on Rm. 102 side.
	106.1	Remove non-historic locks; patch and repair wood jamb and casing. Consolidate and repair bottom wood panel, rails, and stiles. Reglaze sash as required.
	108.4	Replace missing black enamel door knob Rm. 111 side.
	110.2	Replace missing black enamel door knob Rm. 110 side.
	114.1	Consolidate and repair bottom wood panel, rails, and stiles. Reglaze sash as required.
SECOND FLOOR	201.1	Replace entire hardware set, including lock and black enamel doorknobs.
	201.2	
	204.3	Replace black enamel doorknob on Rm. 204 side.
	209.1	
	209.2	Replace both missing black enamel doorknobs and missing brass cylinder.
	210.1	Replace both missing black enamel doorknobs and missing brass cylinder.
	210.2	Replace both missing black enamel doorknobs and missing brass cylinder.

Part J:

Preliminary Cost Estimates

Preliminary Cost Estimate Summary

Appendix B itemizes the preliminary cost estimate for the rehabilitation and restoration of Raspberry Island Lighthouse, including the installation and updating of existing utility service. This summary is exclusive of site development and stabilization which should take place in a future effort.

References

Endnotes

Part A

- ¹ Enviroscience, Inc. *Historic Structure Report, 95% Submittal, Raspberry Island Lighthouse, Raspberry Island Light Station, Apostle Islands National Lakeshore, Bayfield, Wisconsin*. Prepared for the U.S. Department of the Interior, National Park Service, Office of Planning and Resource Preservation, Division of Cultural Resources Management, Omaha, Nebraska, (Eden Prairie, MN: 1990), I-1.
- ² Ibid., I-1.

Part B

- ¹ Charles K. Hyde. *The Northern Lights: Lighthouses of the Upper Great Lakes* (Lansing, MI: Two Peninsula Press, 1986), 14.
- ² Hyde, 14.
- ³ U.S. Department of the Interior, National Park Service, National Maritime Museum. *1994 Inventory of Historic Lighthouses*. (Washington, D.C.: U.S. Government Printing Office, 1994), xvii.
- ⁴ Ibid., xvii.
- ⁵ Hyde, 23.
- ⁶ Margot Gayle and David W. Look. *Metals in America's Historic Buildings*. (Washington, D.C.: U.S. Government Printing Office, 1980), 14.

Part C

- ¹ Vergil E. Noble. "Archeological Trip Report to the Apostle Islands, September 24 -28, 1990." Prepared for the U.S. Department of the Interior, National Park Service, Midwest Archeological Center (Lincoln, NE: 1990), 1.
- ² Ibid., 1.
- ³ Ibid., 1.
- ⁴ Enviroscience, Inc., VI-1.
- ⁵ Enviroscience, Inc., VI-4.
- ⁶ Twin City Testing Corporation. *Geotechnical Exploration Program, Proposed Restoration Construction, Raspberry Island Lighthouse, Apostle Islands, Wisconsin* (Duluth, MN: Twin City Testing Corporation, 1990), 4.

Part D

- ¹ David L. Snyder, comp. *Raspberry Island Lighthouse Historic Structure Report Historical Data Section*. Prepared for the U.S. Department of the Interior, National Park Service, Midwest Regional Office (Omaha, NE: 1994), 40.
- ² Ibid., 144.
- ³ Ibid., 147.
- ⁴ Ibid., 146.
- ⁵ David H. Wallace. *Historic Furnishings Report: Raspberry Island Light Station, Apostle Islands National Lakeshore, Bayfield, Wisconsin*. Prepared for the U.S. Department of the Interior, National Park Service, Midwest Regional Office (Harpers Ferry, WV: 1989), 34.
- ⁶ Snyder, 63.
- ⁷ Wallace, 67.
- ⁸ *Description of Buildings, Premises, Equipment, Etc., at Raspberry Island Light-Station*. Record Group 26. United States Coast Guard, Bureau of Lighthouses, 1911-1939. File 274B and File 274E, National Archives, p.6.
- ⁹ Snyder, 190.
- ¹⁰ Wallace, 107.
- ¹¹ Gayle and Look, 47.
- ¹² Snyder, 47.
- ¹³ Wallace, 80.
- ¹⁴ Snyder, 47.

Part E

- ¹ Snyder, 47.
- ² Snyder, 21.
- ³ Snyder, 32.
- ⁴ David L. Snyder, comp. *A Compendium of Written Communication of the Light House Board for the Twelve Light Stations of the Midwest Region, National Park Service, 1839-1881*. Prepared for the U.S. Department of the Interior, National Park Service, Midwest Regional Office (Omaha, NE: 1994), 10.
- ⁵ David L. Snyder, comp. *Raspberry Island Lighthouse Historic Structure Report Historical Data*

Endnotes (continued)

- Section. Prepared for the U.S. Department of the Interior, National Park Service, Midwest Regional Office (Omaha, NE: 1994), 21.
- ⁶ Ibid., 25.
- ⁷ David L. Snyder, comp. *A Compendium of Written Communication of the Light House Board for the Twelve Light Stations of the Midwest Region, National Park Service, 1839-1881*. Prepared for the U.S. Department of the Interior, National Park Service, Midwest Regional Office (Omaha, NE: 1994), 46.
- ⁸ David L. Snyder, comp. *Raspberry Island Lighthouse Historic Structure Report Historical Data Section*. Prepared for the U.S. Department of the Interior, National Park Service, Midwest Regional Office (Omaha, NE: 1994), 96.
- ⁹ Ibid., 2.
- ¹⁰ Ibid., 118.
- ¹¹ Ibid., 119.
- ¹² Ibid., 148.
- ¹³ Ibid., 142.
- ¹⁴ Ibid., 27.
- ¹⁵ Ibid., 143.
- ¹⁶ Ibid., 144.
- ¹⁷ Ibid., 63.
- ¹⁸ *Description of Buildings, Premises, Equipment, Etc., at Raspberry Island Light-Station*. Record Group 26, United States Coast Guard, Bureau of Lighthouses, 1911-1939. File 274B and File 274E, National Archives, p.17.
- ¹⁹ Ibid., 17.
- ²⁰ David L. Snyder, comp. *Raspberry Island Lighthouse Historic Structure Report Historical Data Section*. Prepared for the U.S. Department of the Interior, National Park Service, Midwest Regional Office (Omaha, NE: 1994), 146.
- ²¹ Wallace, 10.

Part F

- ¹ *Raspberry Island Lighthouse Maintenance Files* (Bayfield, WI: Apostle Islands National Lakeshore Archives).
- ² Enviroscience, Inc., D-2.
- ³ David Arbogast. *Paint Analysis, Raspberry Island Lighthouse, Apostle Islands National Lakeshore*. Prepared for the U.S. Department of the Interior, National Park Service, Midwest

Part G

- ¹ Wallace, 84.
- ² U.S. Department of the Interior, National Park Service. *The Secretary of the Interior's Standards for Rehabilitation and Guidelines for Rehabilitating Historic Buildings*. (Washington, D.C.: U.S. Government Printing Office, 1983), 6.
- ³ Ibid., 6.
- ⁴ Ibid., 28.
- ⁵ Wallace, 83.
- ⁶ Wallace, 85.
- ⁷ Wallace, 85.
- ⁸ U.S. Department of the Interior, National Park Service. *Management Policies* (Washington, D.C.: U.S. Government Printing Office, Dec. 1988), chapter 5, p.14.
- ⁹ Ibid., 14.
- ¹⁰ Wallace, 111.
- ¹¹ Wallace, 111.

Bibliography

- Arbogast, David. *Paint Analysis, Raspberry Island Lighthouse, Apostle Islands National Lakeshore*. Prepared for the U.S. Department of the Interior, National Park Service, Midwest Regional Office, Omaha, Nebraska, January 1991.
- Arbogast, David. *Mortar Analysis, Raspberry Island Lighthouse, Apostle Islands National Lakeshore and Au Sable Lighthouse Complex, Pictured Rocks National Lakeshore*. Prepared for the U.S. Department of the Interior, National Park Service, Office of Planning and Resource Preservation, Division of Cultural Resources Management, Omaha, Nebraska, March 1991.
- Braun Environmental Laboratories. *Bulk Asbestos Analysis Results, Raspberry Island Light Station*. Prepared for Enviroscience, Inc., Minneapolis, Minnesota, October 1990.
- Enviroscience, Inc. *Historic Structure Report, 95% Submittal, Raspberry Island Lighthouse, Raspberry Island Light Station, Apostle Islands National Lakeshore, Bayfield, Wisconsin*. Prepared for the U.S. Department of the Interior, National Park Service, Office of Planning and Resource Preservation, Division of Cultural Resources Management, Omaha, Nebraska, (Eden Prairie, MN), 1990.
- Gayle, Margot and Look, David W. *Metals in America's Historic Buildings*. Washington, D.C.: U.S. Government Printing Office, 1980.
- Hyde, Charles K. *The Northern Lights: Lighthouses of the Upper Great Lakes*. Lansing, MI: Two Peninsula Press, 1986.
- Jennings, Jan and Herbert Gottfried. *American Vernacular Interior Architecture 1870-1940*. New York: Van Nostrand Reinhold Company, 1988.
- MacDonald, Marylee. *Repairing Historic Flat Plaster - Walls and Ceilings, Preservation Briefs, 21*. Washington, D.C.: U.S. Department of the Interior, National Park Service, Preservation Assistance Division, Technical Preservation Services, 1989.
- McAlester, Virginia and Lee. *A Field Guide to American Houses*. New York: Alfred A. Knopf, 1984.
- National Archives. United States Coast Guard, Bureau of Lighthouses, 1911-1939. Record Group 26. "Description of Buildings, Premises, Equipment, Etc., at Raspberry Island Light-Station." File 274B and File 274E.
- Noble, Vergil E. "Archeological Trip Report to the Apostle Islands, September 24-28, 1990." Prepared for the U.S. Department of the Interior, National Park Service, Midwest Archeological Center, Lincoln, NE, 1990.
- Raspberry Island Lighthouse Maintenance Files. Apostle Islands National Lakeshore (APIS) Archives. Maintenance Files.
- Snyder, David L., comp. *A Compendium of Written Communication of the Light House Board for the Twelve Stations of the Midwest Region, National Park Service, 1839-1881*. Prepared for the U.S. Department of the Interior, National Park Service, Midwest Regional Office, Omaha, NE, 1994.
- Snyder, David L., comp. *Raspberry Island Lighthouse Historic Structure Report, Historical Data Section*. Prepared for the U.S. Department of the Interior, National Park Service, Midwest Regional Office, Omaha, NE, 1994.
- Sweetser, Sarah M. *Roofing for Historic Buildings, Preservation Briefs, 4*. Washington, D.C.: U.S. Department of the Interior, National Park Service, Preservation Assistance Division, Technical Preservation Services, 1978.
- Twin City Testing Corporation. *Geotechnical Exploration Program, Proposed Restoration Construction, Raspberry Island Lighthouse, Apostle Islands, Wisconsin*. Duluth, MN: Twin City Testing Corporation, 1990.
- U.S. Department of the Interior, National Park Service. *Management Policies*. Washington, D.C.: U.S. Government Printing Office, December 1988.

Bibliography (continued)

U.S. Department of the Interior, National Park Service, National Maritime Museum. *1994 Inventory of Historic Lighthouses*. Washington, D.C.: U.S. Government Printing Office, 1994.

U.S. Department of the Interior, National Park Service, Preservation Assistance Division. *The Secretary of the Interior's Standards for Rehabilitation and Guidelines for Rehabilitating Historic Buildings*. Washington, D.C.: U.S. Government Printing Office, 1983.

Wallace, David H. *Historic Furnishings Report, Raspberry Island Light Station, Apostle Islands National Lakeshore, Bayfield, Wisconsin*. Prepared for the U.S. Department of the Interior, National Park Service, Midwest Regional Office, Harpers Ferry, WV: Harpers Ferry Center, U.S. Department of the Interior, National Park Service, 1989.

Illustration Index & Credits

Part B	page	Part D	page
Illustration 1	6	Illustration 1	22
Photo by the United States Coast Guard, 1945.		Photocopy from the Apostle Islands National Lakeshore. Original photo ca. 1940s.	
Illustration 2	8	Illustration 2	22
Drawing from the National Archives, Record Group 26. September 1877.		Photocopy from the Apostle Islands National Lakeshore. Original photo ca. 1990s.	
Illustration 3	9	Illustration 3	23
Photo from the Apostle Islands National Lakeshore, Negative No. 1432-2. ca. 1895-1899.		Drawings from the United States Coast Guard Collection, Ninth District Offices, Cleveland OH, microfiche no. RHL 1007636. 1862.	
Illustration 4	10	Illustration 4	24
Drawings from the United States Coast Guard Collection, Ninth District Offices, Cleveland OH, microfiche no. RHL 1007636. 1862.		Photograph by Quinn Evans / Architects. 1995.	
Illustration 5	11	Illustration 5	24
Drawings from the United States Coast Guard Collection, Ninth District Offices, Cleveland OH, microfiche no. RHL 1007636. 1862.		Photograph from the State Historical Society of Wisconsin, Madison. Ca. 1890s.	
Illustration 6	13	Illustration 6	24
Photograph by Quinn Evans / Architects. 1995.		Photo from the Apostle Islands National Lakeshore, Negative No. 1083. ca. 1903-1905.	
Illustration 7	13	Illustration 7	25
Photograph by Quinn Evans / Architects. 1995.		Photo from the Apostle Islands National Lakeshore, Negative No. 1429-9. ca. 1900-1901.	
Illustration 8	14	Illustration 8	25
Photograph from Apostle Islands National Lakeshore, Negative No. 80.45.1. Ca. 1901 - 1903.		Photo from the Apostle Islands National Lakeshore, Negative No. 1432-1. ca. 1895-1899.	
Illustration 9	14	Illustration 9	25
Photo from the Apostle Islands National Lakeshore. 1920.		Photograph by Quinn Evans / Architects. 1995.	
Illustration 10	14	Illustration 10	26
Photocopy from the Apostle Islands National Lakeshore. ca. 1906.		Photograph by Quinn Evans / Architects. 1995.	
Illustration 11	15	Illustration 11	27
Reprinted from <i>A Field Guide to American Houses</i> by Virginia and Lee McAlester. (New York, 1984)p. 78.		Photograph by Quinn Evans / Architects. 1995.	
Illustration 12	15	Illustration 12	27
Reprinted from <i>A Field Guide to American Houses</i> by Virginia and Lee McAlester. (New York, 1984)p. 79.		Photograph by Quinn Evans / Architects. 1995.	
		Illustration 13	28
		Photograph by Quinn Evans / Architects. 1995.	
		Illustration 14	29
		Photograph by Quinn Evans / Architects. 1995.	
		Illustration 15	29
		Photograph by Quinn Evans / Architects. 1995.	
		Illustration 16	30
		Photograph by Quinn Evans / Architects. 1995.	
		Illustration 17	30

Part D (con't)

page	
	Reprinted from David H. Wallace, <i>Historic Furnishings Report</i> . (Harpers Ferry, 1989) p. 171.
Illustration 18	31
	Drawing from the Apostle Islands National Lakeshore. 1932, added to in 1939, 1941, 1946, and 1947.
Illustration 19	32
	Drawing from the Apostle Islands National Lakeshore. 1932, added to in 1939, 1941, 1946, and 1947.
Illustration 20	34
	Photograph by Quinn Evans / Architects. 1995.
Illustration 21a	34
	Photograph by Quinn Evans / Architects. 1995.
Illustration 21b	34
	Photograph by Quinn Evans / Architects. 1995.
Illustration 21c	34
	Photograph by Quinn Evans / Architects. 1995.

Part E

	page
Illustration 1	38
	Drawings from the United States Coast Guard Collection, Ninth District Offices, Cleveland OH, microfiche no. RHL 1007636. 1862.
Illustration 2	39
	Photo from Apostle Islands National Lakeshore, Negative No. 1083. ca. 1903-1905.
Illustration 3	40
	Photo from Apostle Islands National Lakeshore, Negative No. 1429-9. ca. 1900-1901.
Illustration 4	41
	Photo from Apostle Islands National Lakeshore, Negative No. 0978-23. ca. 1930-40.
Illustration 5	43
	Photo from Apostle Islands National Lakeshore, 1974.
Illustration 6	50
	Photo from National Archives, No 26-LG-52-92 b. 1906.
Illustration 7	50
	Photograph by Quinn Evans / Architects. 1995.
Illustration 8	50
	Photo from United States Coast Guard, Ninth Naval District, Cleveland. circa. 1920.
Illustration 9	52
	Drawing by O.G. Brown. 1910.
Illustration 10	52
	Photo from United States Coast Guard, Ninth Naval District, Cleveland. circa. 1913.
Illustration 11	53
	Photo from Apostle Islands National Lakeshore. circa 1920.
Illustration 12	53
	Photo from Apostle Islands National Lakeshore. Negative No. 1424-22. circa. 1936.

Part F	page	Part F	part F
Illustration 1	62	Photograph by Quinn Evans / Architects. 1995.	
Photograph by Quinn Evans / Architects. 1995.		Illustration 22	72
Illustration 2	62	Detail drawing taken from the construction drawing, <i>Raspberry Island Light Station, Wis.</i> Office of the Light-House Engineer, 11th Dist., Detroit, Michigan, October 30th, 1905.	
Drawing from the United States Coast Guard Collection, Ninth District Offices, Cleveland OH, microfiche no. RHL 1007636. 1862.		Illustration 23	72
Illustration 3	62	Photograph by Quinn Evans / Architects. 1995.	
Photograph by Quinn Evans / Architects. 1995.		Illustration 24	72
Illustration 4	62	Photograph by Quinn Evans / Architects. 1995.	
Photograph by Quinn Evans / Architects. 1995.		Illustration 25a	73
Illustration 5	64	Photo from the Apostle Islands National Lakeshore. ca. 1924-1929.	
Photograph by Quinn Evans / Architects. 1995.		Illustration 25b	73
Illustration 6	65	Photograph by Quinn Evans / Architects. 1995.	
Drawing from the Office of the Light-House Engineer, 11th Dist., Detroit, Michigan. October 30th, 1905.		Illustration 26	73
Illustration 7	65	Photograph by Quinn Evans / Architects. 1995.	
Photograph by Quinn Evans / Architects. 1995.		Illustration 27	73
Illustration 8	66	Photograph by Quinn Evans / Architects. 1995.	
Photo from Apostle Islands National Lakeshore. circa 1920.		Illustration 28	74
Illustration 9	66	Photograph by Quinn Evans / Architects. 1995.	
Photograph by Quinn Evans / Architects. 1995.		Illustration 29	74
Illustration 10	66	Photograph by Quinn Evans / Architects. 1995.	
Photograph by Quinn Evans / Architects. 1995.		Illustration 30	74
Illustration 11	67	Photograph by Quinn Evans / Architects. 1995.	
Photograph by Quinn Evans / Architects. 1995.		Illustration 31	76
Illustration 12	68	Photograph by Quinn Evans / Architects. 1995.	
Photograph by Quinn Evans / Architects. 1995.		Illustration 32	77
Illustration 13	68	Photograph by Quinn Evans / Architects. 1995.	
Photograph by Quinn Evans / Architects. 1995.		Illustration 33	77
Illustration 14	68	Photograph by Quinn Evans / Architects. 1995.	
Photograph by Quinn Evans / Architects. 1995.		Illustration 34	79
Illustration 15	68	Photograph by Quinn Evans / Architects. 1995.	
Photograph by Quinn Evans / Architects. 1995.		Illustration 35	80
Illustration 16	69	Photograph by Quinn Evans / Architects. 1995.	
Photograph by Quinn Evans / Architects. 1995.		Illustration 36	86
Illustration 17	69	Photograph by Quinn Evans / Architects. 1995.	
Photograph by Quinn Evans / Architects. 1995.		Illustration 37	87
Illustration 18	70	Photograph by Quinn Evans / Architects. 1995.	
Photograph by Quinn Evans / Architects. 1995.			
Illustration 19	71		
Photograph by Quinn Evans / Architects. 1995.			
Illustration 20	71		
Photograph by Quinn Evans / Architects. 1995.			
Illustration 21	71		

Appendix A: *Mortar Analysis Comparison*



Fitzpatrick Structural Engineering, P.C.

219- 1/2 N. Main • Ann Arbor • MI • 48104

734 - 769 - 0320 • FAX 734 - 769 - 3015

December 28, 2000

Mr. Steve Jones
Quinn Evans /Architects
219-1/2 North Main Street
Ann Arbor, Michigan 48104

RE: Raspberry Island Mortar Samples

Dear Steve;

We have read the report you have provided entitled "Mortar Analysis Raspberry Island Lighthouse Apostle Islands National Lakeshore and Au Sable Lighthouse Complex Pictured Rocks National Lakeshore." The report describes the content of the mortar samples taken from the Raspberry Island Lighthouse. You have requested that we compare the samples to typical mortar mixes.

In general, the lime content in the samples greatly exceeds the portland cement content. The aggregate quantities are inconsistent; some of the samples are below the tolerances used today and some are greater than the tolerances used today. The samples with a relatively high aggregate proportion are relatively weak mortars. There are less cementitious materials (portland cement and lime) to coat the aggregates, resulting in a weaker mortar. The samples with a relatively low aggregate proportion are also relatively weak and susceptible to shrinkage cracking.

Based on the location from which the samples were taken, for brick masonry, Type N or S mortars would be specified today for structural uses above grade; Type M for structural uses below grade. Below is a table of volumetric proportions of lime, portland cement and aggregate specified in ASTM C270 for mortars used with unit masonry:

<u>TYPE</u>	<u>PORTLAND CEMENT</u>	<u>LIME</u>	<u>AGGREGATE RATIO</u>
M	1	0.25	2.25 to 3
S	1	0.25 to 0.5	2.25 to 3
N	1	0.5 to 1.25	2.25 to 3
O	1	1.25 to 2.5	2.25 to 3

The aggregate ratio is the volumetric proportion of the aggregate to the sum of the volumetric proportions of the cementitious materials (portland cement and lime). The aggregate used in the ASTM C270 standard is measured in a damp, loose condition. It is unknown if the aggregate from the samples was measured in this condition. The volume of the aggregates is dependent upon their condition; if the aggregate is dry and compact, a higher aggregate volume will be measured than if the aggregate is loose and wet.

Based on the test report, the majority of the samples have a lime content greater than the portland cement content. Samples 012 and 013 do not have lime at all. Below is a table of the proportions of each sample discussed in the report:

<u>SAMPLE</u>	<u>LOCATION</u>	<u>PORTLAND CEMENT</u>	<u>LIME</u>	<u>AGGREGATE</u>	<u>AGGREGATE RATIO</u>
001	NW Corner of Deck Pillar	1	7	13	1.625
002	North Chimney	1	3	19	4.75
003	East Chimney	1	5	19	3.167
004	North Chimney - Patch	1	4 or 5	9	1.8 or 1.5
005	East Chimney - Patch	1	5	8	1.333
006*	South Chimney - Patch	1	12	20	1.538
007*	South Chimney	1	10	14	1.273
008	SE Corner of Kitchen	1	5	7	1.167
009	Attic - PLASTER	0	2	5	2.5
010	Not Described in Report	---	---	---	---
011	NW Corner of Building	1	4	8	1.6
012	Below grade in Pier	2	0	15	7.5
013	Above Grade in Pier	4	0	13	3.25

* Unreliable samples; sample size too small

Comparing the proportions of the materials derived from the mortar samples to the proportions given in the ASTM C270 table, the mortars can not be clearly identified as Type M, N, S, or O mortars. The high lime content suggests that the mortars are closer to a Type O mortar; a mortar typically used for non-structural uses. The high lime content indicates that the mortar is relatively weak. Generally, the mortars have a low bond, low compressive strength, but are softer or more flexible (less likely to cause distress in the masonry units).

Lime and portland cement differ in their characteristics, thus alter the characteristics of the mortar created from these products. Portland cement offers a greater compressive strength and a greater bond than the lime, however, it is more brittle and water can penetrate easily. Lime offers good workability, is resistant to cracking, and is resistant to water penetration. Typically, a combination of the lime and portland cement is used to produce the optimum mortar type for the intended use.

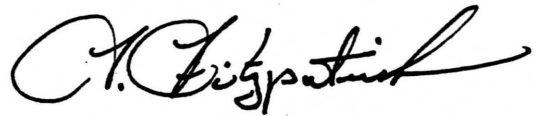
Other factors should be considered when analyzing the condition of the mortar. How has the mortar performed? Is the mortar cracked in many locations? Is the mortar missing? Can aggregate or dust be easily rubbed off? Historically, mortars with no portland cement content at all have performed rather well over time. The quality and endurance of the mortar depends greatly upon the skill of the mason and how the masonry was laid up. If the masonry units are relatively absorbent units and they were not pre-moistened, the water in the mortar mix would have been absorbed before the chemical reaction (hydration) of the portland cement and lime could completely occur. This results in poor bond characteristics.

In the future, if tuck-pointing is to be done, Type N or S mortars should be used. Type S is slightly more durable than Type N, especially given the climate where the lighthouse is located.

Sincerely,

A handwritten signature in cursive script, appearing to read "Cheryl Kryscynski".

Cheryl Kryscynski, P.E.

A handwritten signature in cursive script, appearing to read "T.R. Fitzpatrick".

Thomas R. Fitzpatrick, P.E.