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Sable Points Lighthouse Keepers
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MANAGEMENT SUMMARY

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Executive Summary

Located on the eastern shore of Lake Michigan, the Big Sable Point Light Station (Latitude North 44° 03' 29" Longitude - West 86° 30' 53") is situated approximately nine miles north of Ludington, Michigan. The station is owned by the State of Michigan and is located within Ludington State Park. The non-profit organization, Sable Points Lighthouse Keepers Association (SPLKA) and the Parks and Recreation Division of the Department of Natural Resources jointly manage and operate the structures and grounds around them.

First constructed in 1867, the Big Sable Point Light Station has served as an active aid to navigation for 156 years. Initially run by the U.S. Lighthouse Establishment (USLHE), which was renamed the U.S. Lighthouse Service (USLHS) in 1910, and later by the U.S. Coast Guard (USCG), the station was operated by lighthouse keepers and USCG personnel for 104 years. Several structures were built at the station, as well as moved and renovated, during the period in which it was operated by keepers and crew. The light was automated in 1968 and resident personnel left the station in 1971.

BACKGROUND AND HISTORY

The point of land projecting into Lake Michigan approximately nine miles north of Ludington was originally referred to as Grande Pointe au Sable by French explorers and traders. The U.S. Government first surveyed this area in 1838. By the 1850s, Grande Pointe au Sable had become a prominent landmark for mariners traveling along this often-treacherous stretch of the lake.

Congress appropriated funding for a lighthouse at Grande Point Au Sable in 1856. Historic documents differ as to whether the President reserved land for the lighthouse in 1856 or 1858. This initial land reservation was referred to as a "bluff of land" and a "sand bank" on historic documents and appears as a small island just offshore on historic drawings. Henry Lapaute of Paris, France fabricated, shipped and invoiced for a Fresnel lens for the lighthouse in 1857. While funding was secured, land reserved, and a lens made ready, only $881.46 were spent. The rest of the funding was returned to the Congressional surplus fund in 1859. It is not known why the lighthouse was not built nor why the money was returned. There has been commentary that it was because it was needed in the government coffers to help fund the Civil War. It is also not currently known whether the Fresnel lens was returned to the fabricator or installed at another lighthouse.

Although a lighthouse was not built, the need for it remained. Commerce linked to the burgeoning lumber industry demanded that the point be suitably lighted. State Senator Charles Mears also pressed the legislature to ask the federal government for a light station at Big Sable. In response to this, Congress appropriated funding in July 1866. Additional land was also reserved for a much larger lighthouse reservation. This land was deeded to the federal government by the State of Michigan.

Construction of the lighthouse – a tower attached to a keeper's dwelling by an enclosed passageway – was completed in 1867. Although the very limited construction drawings that have been located are not signed, the configuration and details of the light tower are signature elements of the Lighthouse Board's chief Engineer, Orlando Poe.

The tower, passageway and keeper's dwelling were all built of Milwaukee "Cream City" brick on stone foundations. The main portion of the Keepers' Dwelling was 1-1/2 stories, with a basement under half of it. The main entrance was at the west gable end, facing the lake. A single-story, shed-style roof section extended from the east side. This simple design was used at many light stations during the 1860s – 1870s. There were four rooms on both the first and second stories.

The Fresnel lens was installed and the lighthouse keeper and assistant keeper were selected in the fall of 1867. The third-order Fresnel lens was fabricated by Louis Sautter & Company of Paris, France. According to the Port of Ludington Maritime Museum, this was the second-largest lens installed at a Lake Michigan lighthouse. The lighthouse was lighted for the first time on the night of November 1, 1867. A circular iron oil house was installed south of the Keepers' Dwelling in 1892.

By 1898, the brick on the tower was in very poor condition. To address this issue, the tower was encased in iron plates up to the watchdeck level in 1900. The original windows were removed and porthole windows were installed in the metal casing outboard of the original window

openings. The metal panels were painted black and white in the same configuration as remains today. The lantern was originally painted white, but was later painted black in 1916, as it remains today.

A small brick oil house was built at the station in 1903. By 1908, mariners had been expressing the need for a fog signal at this station, and the Lighthouse Board recommended a fog signal building be built. The fog signal building was constructed in 1908 – 1909 and put into operation on May 20, 1909. The building was brick, with a concrete floor and red asbestos roof shingles. The fog signal equipment consisted of two 22-horsepower kerosene oil engines with compressors and air tanks, and a first class automatic compressed-air siren.

The addition of a fog signal added to the lighthouse keeper's workload, and a second assistant keeper was assigned to the station. Drawings were prepared in 1908 to expand the keeper's dwelling to accommodate three keepers. Construction was complete by the summer of 1909. The one-story portion was removed and a two-story addition was added at the east side of the dwelling. Dormers were added in the original second floor to provide more usable floor space. Four porches were added and several upgrades were also made to the existing portion of the dwelling. The lighthouse keeper's residence comprised both the first and second floors of the original portion of the dwelling. The first floor of the addition was the assistant keeper's residence, and the second floor was for the second assistant keeper. Each keeper was assigned a cellar area in the basement.

The illuminating apparatus in the Third Order lens was upgraded from a kerosene-fueled lamp to a more efficient incandescent oil vapor (IOV) system in 1910. The name of the station was also officially changed that year to Big Sable Light Station. At the same time, the name of a light station located on Lake Superior that had been previously named Big Sable Light Station was changed to Au Sable Light Station. Another development in 1910 was the construction of a large, brick oil house adjacent to the fog signal building. A boathouse was built at the station sometime between 1910 - 1914.

In 1926, it was determined that a large portion of the lighthouse reservation could not be profitably used in the work of the Lighthouse Service. In May, Congress approved conveying the land to the State of Michigan for public park purposes. The 800 acres of land was deeded to the state with a requirement that the state build and maintain a road to the station. Following the land conveyance, the size of the lighthouse reservation was approximately 30 acres. The road was officially dedicated in 1928 and the Michigan Department of Conservation constructed it in 1932-33. The fog signal equipment was replaced in 1934.

A very strong storm struck the area on November 12, 1940. In addition to several shipwrecks resulting in loss of life, the storm also caused severe shoreline erosion. The erosion was dangerously close to the fog signal building and large oil house. The erosion continued through 1941 and the large oil house had collapsed by November. With concern that the fog signal building may also collapse, measures were undertaken to safely continue providing a fog signal to mariners. A new fog signal tower was constructed northeast of the fog signal building and a separate control building to house the fog signal equipment was built further east, near

the lighthouse. The boathouse was also moved several yards east to a location south of the keepers' dwelling in 1941 and later converted into a workshop and storage building. The erosion of the shoreline continued and the original fog signal building collapsed in January of 1942.

Shoreline erosion continued throughout 1942 and 1943. Temporary timber shore protection that was constructed around the new fog signal tower in June of 1943 began collapsing by August. Steel sheet piling was installed later in the fall along a greater length of the shore and rip rap was installed at the north and south ends of the new steel seawall in 1944.

The keepers' dwelling was first painted white and a four-car garage was built southeast of the dwelling in 1941-1942. Electricity was introduced to the station in 1945 via generator. The generators were located in the fog signal control building. The lighting apparatus changed from the IOV system to electric bulbs, resulting in a substantial increase in candlepower.

Another expansion and upgrades of the keepers' dwelling were completed in 1948-1949. The east porch was removed and a two-story addition was added to the east side of the dwelling. A new, enclosed porch was added at the southeast corner of the house. A wall was added in the assistant keeper's residence to create a hall at the central stair, providing access to both the assistant and second assistant residences from the central, south porch. This expansion brought the dwelling to its present-day configuration. The upgrades included indoor plumbing, bathrooms and hot water heating.

Commercial electric power was extended to the station in 1951-53. The garage was updated in 1955-56 with a new foundation, concrete floor slab and overhead doors.

The road to the light station was rerouted in the early 1950s due to erosion and dune encroachment caused by high water levels. To counter erosion due to the high water levels, additional sheet piling with perpendicular groins was also installed extending north from the original seawall in the early 1960s.

In 1966-1967, most of the remaining land reservation was ceded to the State of Michigan, reducing the station size to 15 acres. The light was automated and the fog signal was discontinued in 1970. A stand-by light was installed on the lantern gallery in 1971. 1971 was the last year that "Resident Personnel" were listed on the Great Lakes Light List. With the light automated, and a standby light in operation, the buildings were vacated. Photographs from this time period indicated some of the windows were boarded up.

The State of Michigan leased the station for a short period of time to the Foundation for Behavorial Research in the 1970s. This foundation used the station for research and analysis, with students and staff living in the Keepers' Dwelling and former Fog Signal Control Building. After the departure of the foundation, the station was extensively vandalized later in the 1970s.

High water levels in the 1970s resulted in a portion of the shoreline protection being breached, causing severe erosion at the base of the tower and fog signal control building. The fog signal tower was gone in 1978. It is not known at this time if it was removed or collapsed into the lake similar to the former fog signal building. Erosion continued in the following years and the fog signal control building collapsed after an April 1982 storm. The concrete from the structure was used as rip rap to provide shore protection near the light tower.

The garage and workshop (converted boathouse) were torn down in 1984 and the rubble from them was dumped at the water's edge for additional erosion control along the shoreline. Due to concerns with stability of the tower and vandalism, the USCG removed the Fresnel lens from the lantern in 1985, and a contemporary plastic lens was installed. The USCG also erected a contemporary pole light tower southeast of the remaining station buildings, perched on a dune at a distance from the eroding shoreline. Based on review of historic documents and photos, the new pole light was never put into service and was later removed in 1996.

The steel sheet piling seawall was extended approximately 150 feet to the south in the winter of 2012-2013 to address continued shoreline erosion.

SABLE POINTS LIGHTHOUSE KEEPERS ASSOC

The Big Sable Point Lighthouse Keepers Association (BSPLKA) was formed in 1987 by a small group of local Ludington residents dedicated to restoring and preserving Big Sable Point Lighthouse. BSPLKA was awarded the lease on the station that same year. BSPLKA led several restoration efforts in the late 1980s and 1990s. This included substantial shoreline erosion mitigation and prevention measures, as well as extensive repairs and repainting of the light tower metal cladding. Additional restoration work in the 1990s included masonry repointing and replacement of the front porch floor.

BSPLKA incorporated as a Non-Profit 501 (c) (3) in 1991. During the 1990s, restoration of the station continued in earnest. Restoration and upgrade work included replacement of the Keepers' Dwelling roof, wood floor restoration, asbestos removal, painting, and upgrading of heating, electrical and plumbing systems.

By 2012, the organization was stewarding four lighthouses within a thirty mile stretch of Lake Michigan's shoreline near the Ludington area: Big Sable Point, Little Sable Point, Ludington North Breakwater and White River Light Station and Museum. At this time, BSPLKA officially changed its name to Sable Points Lighthouse Keepers Association (SPLKA).

Since its inception, SPLKA's mission has been the restoration, preservation, education and accessibility of their lighthouse charges. SPLKA has continued to work diligently over the years to stabilize, restore and maintain the Light Tower and Keepers' Dwelling in accordance with their mission. To further enhance and augment their efforts, SPLKA commissioned this Historic Structure Report (HSR) to document the history of the structures and site; record existing conditions; and to plan a path for the long-term further restoration and preservation of the light station. This HSR is funded in part by a grant from the Michigan Strategic Fund (MSF), State Historic Preservation Office (SHPO) and the Michigan Lighthouse Assistance Program (MLAP).

Beginning in the late 1990s, the organization offers a variety of opportunities for which members can volunteer for one to two week resident keeper commitments (tour of service), day keeping shifts, events, and restoration projects at the lighthouses SPLKA manages. Resident keepers at Big Sable Point Lighthouse stay for two-weeks and are responsible for a variety of tasks including: welcoming guests, historical interpretation, overseeing tower climbs, running the gift shop, cleaning, and grounds work. SPLKA intends to continue this successful program.

The opportunity to climb the light tower is offered during the months of May through October. The station is accessed by the public by walking along the shore or park road. Making accessibility a priority, SPLKA also offers multiple bus days where visitors can ride a bus out to the light station. Ludington State Park also has motorized tracked wheelchairs to allow assist with accessibility. SPLKA also welcomes educational visits from all sizes and types of school groups and provide lesson plans developed by educators and linked to Michigan Content Standards on their website.

STATEMENT OF SIGNIFICANCE

The Big Sable Point Light Station was listed on the National Register of Historic Places in 1984 and the State Register of Historic Places in 1988. The station is listed on the National Register of Historic Places as part of the Multiple Resource Thematic nomination titled "United States Coast Guard Lighthouses and Light Stations on the Great Lakes." The theme of this nomination is the design and construction of lighthouses and light stations on the Great Lakes prior to 1930. The nominated buildings and structures were essential to the rapid expansion of the Great Lakes maritime commerce from the 1850s through the 1920s. They illustrate the evolution of lighthouse design and construction methods in response to changing requirements of Great Lakes shipping as the volume of traffic increased, routes changed, and the size and speed of ships increased.

The specific dates of significance of the overall listing are 1832 – 1919. The nomination was based on the buildings and structures identified in the Historic American Engineering Record (HAER) Great Lakes Survey conducted for the United States Coast Guard in 1979. The HAER Inventory document prepared for the Big Sable Point Light Station lists the significant dates as 1867-1905. These dates are based on the construction dates of the original light tower/dwelling/passageway (1867) and the completion of the metal encasement of the tower (1905).

1867 should remain designated as a date of significance, as it was the year that the light station was established. Based on the analysis of historic documentation, additional dates of significance include 1909 (year fog signal established and Keepers' Dwelling expanded), 1941-1942 (years original fog signal building and large oil house collapsed, and new fog signal tower and control building built), and 1949 (addition and upgrades to the Keepers' Dwelling). The recommended period of significance is the entire time that the station was in operation with resident personnel: 1867 - 1971.

Recommended Period of Interpretation

Since its construction, the Big Sable Point Light Station has served only one purpose – to provide aids to navigation. As such, alterations have been limited to technological upgrades and subsequent modifications related to these upgrades (such as construction of new buildings and modifying structures for additional personnel that came to the station due to the technological upgrades). All of the structures contributed to the success of the station. Therefore, it is recommended that the period of 1949 – 1971 (Episode 5) be established as the Period of Interpretation. This is the period of time that includes the presence of all structures built at the light station with the exception of the 1909 Fog Signal Building and early barns. The configuration of the Keepers' Dwelling from this period remains today. This period also represents the last reduction in size of the lighthouse reservation.

RECOMMENDATIONS AND COST BUDGETS

PHASE 1 - $763,000

Further analyze and address material deterioration and deficiencies

Phase 1 work is the highest priority and includes further analyzing and addressing exterior masonry deterioration at the Keepers' Dwelling and Passageway and structural repairs at the Light Tower spiral stair and lantern gallery. It is recommended that this work be completed as soon as funding is available.

PHASE 2 - $282,000

Continued Rehabilitation

Phase 2 work includes continued rehabilitation work. It is recommended that this work be completed within three to five years.

PHASE 3 - $412,500 - $583,000

Visitor Safety and Accessibility Improvements, Enhanced Intrepretation and Visitor Experience

Phase 3 work includes recommended improvements at existing buildings and reconstruction of former buildings from the Period of Interpretation. It is recommended that this work be implemented as funding allows.

Phase 4: Long-Term Renewal - $1,007,000

Phase 4 work includes long-term rehabilitation efforts that will eventually be required, including roof replacement and restoration of the windows at the Keepers' Dwelling and Passageway, and tower repainting.

Sable Points Lighthouse Keepers
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Administrative Data

Property Identification Information

Located on the eastern shore of Lake Michigan, the Big Sable Point Light Station (Latitude North 44° 03' 29" Longitude, 86° 30' 53" West) is situated approximately nine miles north of Ludington, Michigan. The station is owned by the State of Michigan and is located within Ludington State Park. The non-profit organization, Sable Points Lighthouse Keepers Association (SPLKA) and the Parks and Recreation Division of the Department of Natural Resources jointly manage and operate the structures and grounds around them.

Big Sable Point Light Station is listed on the National Register of Historic Places as part of the Multiple Resource Thematic nomination "United States Coast Guard Lighthouses and Light Stations on the Great Lakes." The station, located in Mason County, is identified as reference number 83004296 in the National Register Database/Research searchable table on the National Register of Historic Places website.

Investigation Methodology

Physical investigation of the station was undertaken for this HSR July 18 - 21, 2023. All investigative techniques were undertaken with respect for the material and historical sensitivity of the structures. Investigations were made using visual observation techniques and were non-destructive with the exception of the lab analysis and selective removal of brick masonry at the north wall of the north porch. On the exterior, the assessment was completed from the ground level; lifts, scaffolding or other equipment were not used in this field evaluation. Consequently, some elements could not be fully evaluated due to inaccessible or concealed conditions.

Research Sources

Several published, archival, and online resources were reviewed and analyzed for preparation of this HSR. Significant sources included textual, cartographic and photographic archival materials included in the U.S. Coast Guard (USCG) files at the National Archives and Records Administration in Washington, D.C. and College Park, Maryland; archival materials located at the USCG Historian's Office in Washington, D.C., and photographs, drawings and documents provided by the SPLKA. A full listing of all resources is included in the bibliography. A spreadsheet listing each of the resources with notes and digital file names is also included in the appendices. The project team will provide SPLKA, SHPO, and DNR a digital copy of all digital resources that were gathered.

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This HSR is funded in part by a grant from the Michigan Strategic Fund (MSF), State Historic Preservation Office (SHPO) and the Michigan Lighthouse Assistance Program (MLAP).

Archival Storage of HSR

Hard and electronic copies of this HSR will be kept at the offices of Sanders & Czapski Associates, Smay Trombley Architecture, the State Historic Preservation Office, the Department of Natural Resources, Parks and Recreation Division and SPLKA. A copy will also be provided to the Library of Michigan.

Sable Points Lighthouse Keepers
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PART I: DEVELOPMENTAL HISTORY

This section of the HSR documents the history and evolution of the Big Sable Point Light Station, its current condition, and the causes of its deterioration. Documentary research for this section includes review of historical information (written, cartographic and pictorial documentation) obtained from the SPLKA, the National Archives and Records Administration, the USCG Historian's Office, and other sources as noted in the bibliography. Analysis of current conditions is based on physical examination of the station undertaken on July 18 - 21, 2023.

Part 1 includes the following:

1A - Historical Background and Context

This section provides historical context for the Big Sable Point Light Station, including a brief history of the United States Lighthouse Establishment and Coast Guard; general lighthouse types; and the historical development of lighthouse equipment.

1B – Historical Overview

This section provides an historical overview of the station, including a summary of the construction, evolution, people and events associated with the light station. This section includes the history of the many structures at the station during its history, including the tower, keeper's dwelling, fog signal building, boathouse, garage, oil houses, fog signal tower, control building and other outbuildings and structures.

1C - Chronology of Development and Use

This section provides a summary of the construction, modifications, and use of the station. This section was developed through analysis and coordination of the historical information obtained with the physical evidence observed during on-site physical investigation. This information is organized into two parts:

- A summary chronological timeline divided into distinct episodes of time that is based on significant events, activities, and/or physical changes at the station.
- A written and photographic analysis of the construction, modifications, use, historical evolution and development of the existing structures.

This section also includes discussion of the Period of Significance at the station and the recommended Period of Interpretation that should be recognized as the station is rehabilitated. The recommended Period of Significance and recommended Period of Interpretation are based on both the history and the existing conditions at the Big Sable Point Light Station as well as SPLKA's goals for use and interpretation of the station.

1D - Physical Description

This section includes a physical description, observations and analysis of the existing conditions at the Big Sable Point Light Station. This content is based on field investigation undertaken by the project team July 18 - 21, 2023 in conjunction with review of historical documentation, code criteria, and the project team's experience.

1A Historical Background + Context

THE UNITED STATES LIGHTHOUSE ESTABLISHMENT AND COAST GUARD

The first North American lighthouse was constructed in 1716 on Little Brewster Island in Boston Harbor. Several more lighthouses were subsequently built along the Atlantic Seaboard during the next several years. These lighthouses, as well as others built in the eighteenth century, were built and maintained by individual colonial governments and private organizations affiliated with maritime commerce. In 1789, with passage of the Lighthouse Act, Congress provided for the transfer of all twelve existing lights, and future lighthouses, to the Federal Government through the formation of the United States Lighthouse Establishment (USLHE). Once transferred, all maintenance and repairs were the responsibility of the Federal Government. It is important to note that it took several years for some of the lights to transfer—not all were immediately transferred to the U.S. government in 1789.

In its early years, the growth and administration of the USLHE was slow and full of political corruption. Much of this inefficiency has often been attributed to Stephen Pleasonton, Fifth Auditor of the U.S. Treasury Department. Pleasonton was appointed to the position by President James Monroe in 1817 and in that capacity served as the administrative head of the USLHE for over thirty years. Pleasonton, who had no engineering or maritime experience, also oversaw accounts for the U.S. State Department and U.S. Patent Office and was generally more concerned about budget and expenses than the quality of lighthouse construction, maintenance and repairs. For example, during his tenure, there was no on-site supervision of contractors during the building of Great Lakes lights.[1] As a result, many of these early lights were substandard and had to be extensively repaired, rebuilt or replaced.

To alleviate the corruption and expedite growth and efficiency, Congress appointed a nine-member board in 1852 to replace Pleasonton. The new Lighthouse Board of the United States was comprised of naval and army engineers and maritime professionals. Although Pleasonton became the ex-officio president of the Lighthouse Board, the management of the USLHE and its facilities rested in the hands of the nine board members.

Each U.S. lighthouse belonged to a lighthouse district whose numbers, extent and associated geographic areas varied over time. In 1838, the president, with the authority of Congress, created six lighthouse districts to oversee lights on the Atlantic Coast and two districts on the Great Lakes. One of the first responsibilities of the newly formed 1852 Lighthouse Board was to expand the number of districts, although not to exceed twelve. Although the number of districts increased to twelve, the number of lighthouses in each district was lowered, making the districts easier to manage.

The lighthouse districts were individually governed by a regional district administration that consisted of a superintendent, inspector, and engineer.

- *District Superintendent*—Oversaw the workings of the entire district. The Superintendent answered directly to the Lighthouse Board (and later the Commissioner of Lighthouses) on all matters relating to his district.
- *District Inspector*—Responsible for the personnel, inspections, and general administration of each of the individual light stations within the district. The inspector was the direct supervisor of the lighthouse keepers and enforced the rules and regulations of the Federal lighthouse authority, i.e., USLHE.
- *District Engineer*—Responsible for all construction and repairs of the light stations within the district; was typically a member of the U.S. Army Corps of Engineers.

Each lighthouse district maintained a headquarters and main depot within the district that served as the administrative and supply center. Several secondary depots were also located throughout the district. Each district had a small fleet of tenders to transport supplies, work crews and the engineer and inspector to the light stations. Work crews for each district would travel throughout the district to undertake construction and larger maintenance and repair projects. Smaller projects and maintenance were undertaken by individual light keepers.

In 1852, the lighthouses of Lakes Huron, Michigan and Superior were assigned to the Eleventh District. In 1874, Lake Michigan became the Twelfth District, while Lakes Huron and Superior remained in the Eleventh. In 1886, another lighthouse district reorganization took place, at which time the total number of districts increased to sixteen. Lake Michigan lights were assigned to the Ninth District as part of this reorganization. Light stations on Lakes Erie and Ontario joined the Tenth District and lights on Lakes Superior and Huron remained in the Eleventh District.

On July 1, 1903, the USLHE and Lighthouse Board were transferred out of the Treasury Department and into the U.S. Department of Commerce and Labor. In 1910, Congress abolished the Lighthouse Board (36 Stat. L., 534) and created the Bureau of Lighthouses. At that same time, the operating name of the USLHE changed to the United States Lighthouse Service (USLHS). Unlike the USLHE's Lighthouse Board, civilians, rather than military personnel, were now assigned to manage the USLHS. That same year, the total number of lighthouse districts expanded to eighteen to establish districts for Puerto Rico, Hawaii and Alaska. Existing districts were also reorganized at this time and Lake Michigan was reassigned to the Twelfth District.

George Putnam, who had a long and distinguished career with the U.S. Coast & Geodetic Survey, was appointed the first Commissioner of the new bureau. He would reign until May 31, 1935 when he was forced to retire due to age. Prior to assuming control over the Lighthouse Service, Putman was director of the coastal surveys of the Philippines. Once appointed to the new bureau, he took firm control and instituted, not only the new administration, but implementation of many technological advances including radiobeacons. At his retirement luncheon, the Secretary of Treasury Daniel Roper congratulated Mr. Putnam on his distinguished career of 45 years and noted that while aids to navigation had increased from around 12,000 to 24,000 during his tenure, the number of employees dropped from 5,832 to 4,980. Putnam was replaced by H.D. King who headed up the bureau until the Coast Guard assumed control in 1939.[2]

In 1913, when the U.S. Department of Commerce and Labor was separated into two departments, the Bureau of Lighthouses was assigned to the Department of Commerce. On July 1, 1939, the USLHS merged with the USCG within the Department of Treasury and the Bureau of Lighthouses was abolished. With this transition, the Great Lakes light stations became part of the Ninth Coast Guard District. In 1967, the USCG was transferred out of the Treasury Department and into the U.S. Department of Transportation. This governance jurisdiction continues today with the Big Sable Point Light Station operating as an active aid to navigation within the USCG's Ninth District. See Figure 1A-01 for a summary of the USLHE/USLHS/USCG organization and management.

LIGHT STATION STRUCTURES

A light station typically consisted of a complex of interdependent structures designed for utilitarian purposes. The light required a keeper for both daily operation and on-going maintenance. At stations that also had a fog signal, which was the majority, at least one additional keeper was needed for its operation and maintenance. Due to these time-consuming responsibilities, as well as the typically remote location of the station, the keeper(s) needed a

Date	Federal Parent Agency	Federal Lighthouse Authority	Managing Agent/Agency	Executive
1789	U.S. Department of the Treasury	United States Lighthouse Establishment USLHE	5th Auditor	
1852	U.S. Department of the Treasury	United States Lighthouse Establishment USLHE	Lighthouse Board	
1903	U.S. Department of Commerce & Labor	United States Lighthouse Establishment USLHE	Lighthouse Board	
1910	U.S. Department of Commerce & Labor	United States Lighthouse Services USLHS	Bureau of Lighthouses	Commissioner of Lighthouses
1913	U.S. Department of Commerce	United States Lighthouse Services USLHS	Bureau of Lighthouses	Commissioner of Lighthouses
1939	U.S. Department of Treasury	United States Coast Guard USCG		
1967	U.S. Department of Transportation	United States Coast Guard USCG		

Figure 1A-01: Summary table of the Federal Government organizational and management structure of U.S. lighthouses.

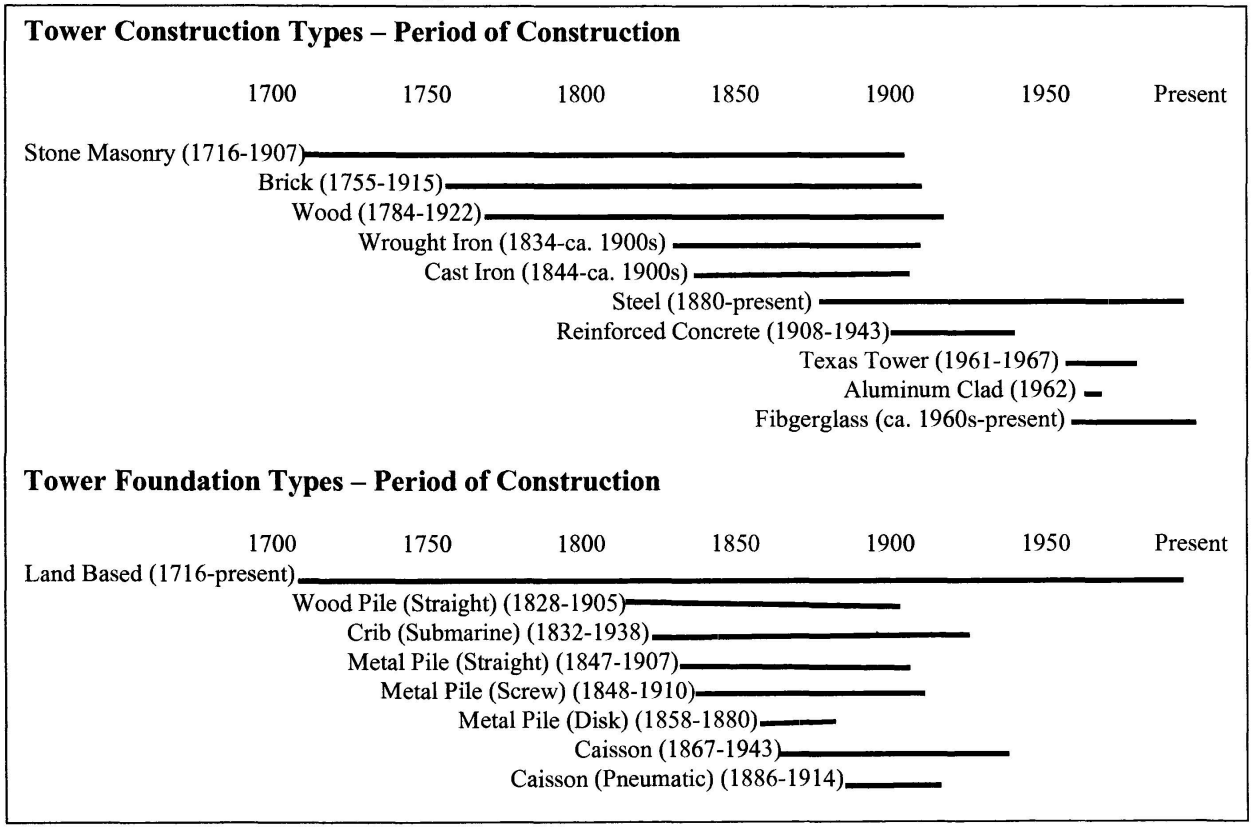
place to live on site as well as transportation to and from the site. Thus, in addition to the light tower and a building to house the fog signal, the stations typically had at least one dwelling and privy, storage buildings for fuel and other materials and some form of transportation storage, which was usually a boathouse, stable or garage depending on the location of the light station. At the very minimum, a station would have a tower containing both the light and living quarters for the keeper. As technology progressed relative to maritime navigation, additional structures were often added to light stations, e.g., radiobeacons, while other existing structures were adaptively re-used for new purposes.

LIGHTHOUSE TYPES

Most lighthouses can be categorized by their construction method, shape, building material or foundation type. In addition to the specific location's need (e.g., guiding mariners around dangerous shoals or into safe harbors), location, geography, available materials, cost, politics, current technology and popular architectural styles of the period influenced lighthouse designs. The United States has more lighthouses and diverse architectural engineering types than any other country in the world.[3]

Lighthouses in the United States built prior to 1850 typically consisted of towers and separate/detached dwellings built of local, readily available materials, mainly stone and brick and later wood. Due to the previously mentioned lack of supervision of these early structures, they were often of substandard quality. Technological developments and congressional mandates for the professional management of lighthouse construction in the latter half of the nineteenth century led to more diverse construction types

U.S. lighthouse typology chronology[24]



[24] This timeline is for United States lighthouses; tower and foundation construction types were sometimes used earlier or later in other countries. The dates are meant only to give relative time, not absolute first and last use of this construction type.

Figure 1A-02: This is a timeline is of U.S. lighthouse typologies. The dates are meant only to give relative time, not absolute first and last use of construction type.

of better quality. Figure 1A-02 is a table showing the chronology of lighthouse types.

Due to the increasing number of light stations being established in the Great Lakes during the second half of the nineteenth century, the district engineers (and their Canadian counterparts) often produced and utilized standard designs for the construction of lighthouses and related outbuildings at the stations. The rapid increase in lighthouse construction was making it difficult to develop unique designs for the structures at each station. Nearly identical buildings such as light towers, fog signal buildings, keeper's dwellings and other outbuildings, can be found at several light stations around the Great Lakes. While the goal of these standardized designs was efficiency, slightly modified details such as window type and location were incorporated to provide a semblance of individuality.

The efficient use of standardized designs resulted in ten basic styles and numerous other individual or modified styles of light towers on the Great Lakes:[4]

- *Conical*—Tower usually made of stone or brick; utilized at Big Sable.
- *Skeletal*—Tower made of wood, iron or steel; Manitou Island (Lake Superior) is an example.
- *Pyramidal*—Tower made of wood or iron plate; Frankfort (Lake Michigan) is an example.
- *Pyramidal Style*—Tower with attached dwelling made of wood. This was a Canadian

style utilized because they were inexpensive to erect and could be moved if necessary. An extant example is at Salmon Point (Lake Ontario).

- *Schoolhouse Style*—Made of wood or brick, it is basically a rectangular building (dwelling) with a square tower up the middle at one end on the outside of the building; utilized at Gull Rock and Copper Harbor (Lake Superior).
- *Octagonal*—Brick, stone or wooden tower; some were affixed to a corner of the dwelling such as at Eagle Harbor (Lake Superior).
- *Round or Cylindrical*—Tower made of brick or stone; Beaver Island Harbor Lighthouse in St. James (Lake Michigan) is an example.
- *Square*—Tower, often brick with a circular brick liner; Forty Mile Point (Lake Huron) is an example or steel as at North Manitou Shoal (Lake Michigan).
- *Square Integral*—Tower made of wood or steel , it is basically a building (dwelling) with a square tower going up from the inside of it; utilized at Fairport Harbor West Breakwater (Lake Erie).
- *Flying Buttress*—Canadian style tower; utilized at Caribou Island in eastern Lake Superior.

ILLUMINATION - LANTERN AND LENS DEVELOPMENT

As described by Francis Ross Holland, Jr., in *America's Lighthouses: An Illustrated History*, "Over the centuries the light tower has supported a variety of lights, but until the most recent years, when electricity came into use, the light has been a flame in one form or another. The history of the development of the lighthouse light is the story of the refinement and adaptation of the flame. It was so refined through the years that by the time of the introduction of electricity, the flame was virtually no longer a flame—it was a glowing ball."[9]

Argand Lamp

Until the introduction of enclosed lamps in the 1700s, lighthouses used wood, coal and candles to fuel these flames. Although they had been used in U.S. lighthouses for many years, these lamps were problematic because they produced a significant amount of smoke, which dimmed the light, and gave off acrid fumes. The fumes burned the nostrils and eyes of keepers so much so that they couldn't remain in the lantern very long to service them.

The first successful solution to this problem was the invention of a lamp with a hollow circular wick by Swiss physicist and chemist Aimé Argand in 1781. Because oxygen passed along the inside and outside of the wick, the flame burned intensely and brightly and, more importantly, smokelessly.[10] Argand patented this lamp in England where it was soon commonly used in both public buildings and private homes. There is some disagreement as to who was the first to place parabolic reflectors behind Argand's lamp to further boost and concentrate the output (Figure 1A-03). H L. Reynaud, Director of the French Lighthouse Service, credited Aimé Argand himself with the first proposal for an apparatus using an Argand lamp and a reflector. This combination represented a considerable improvement over illumination systems used at the time and quickly came into widespread use in European lighthouses. However, the incorporation of Argand's lamp technology with parabolic reflectors in U.S. lighthouses is attributed to Winslow Lewis.[11] Lewis had patented a reflecting and magnifying lantern in the United States that was essentially a modified version of Argand's lamp. Although Lewis's

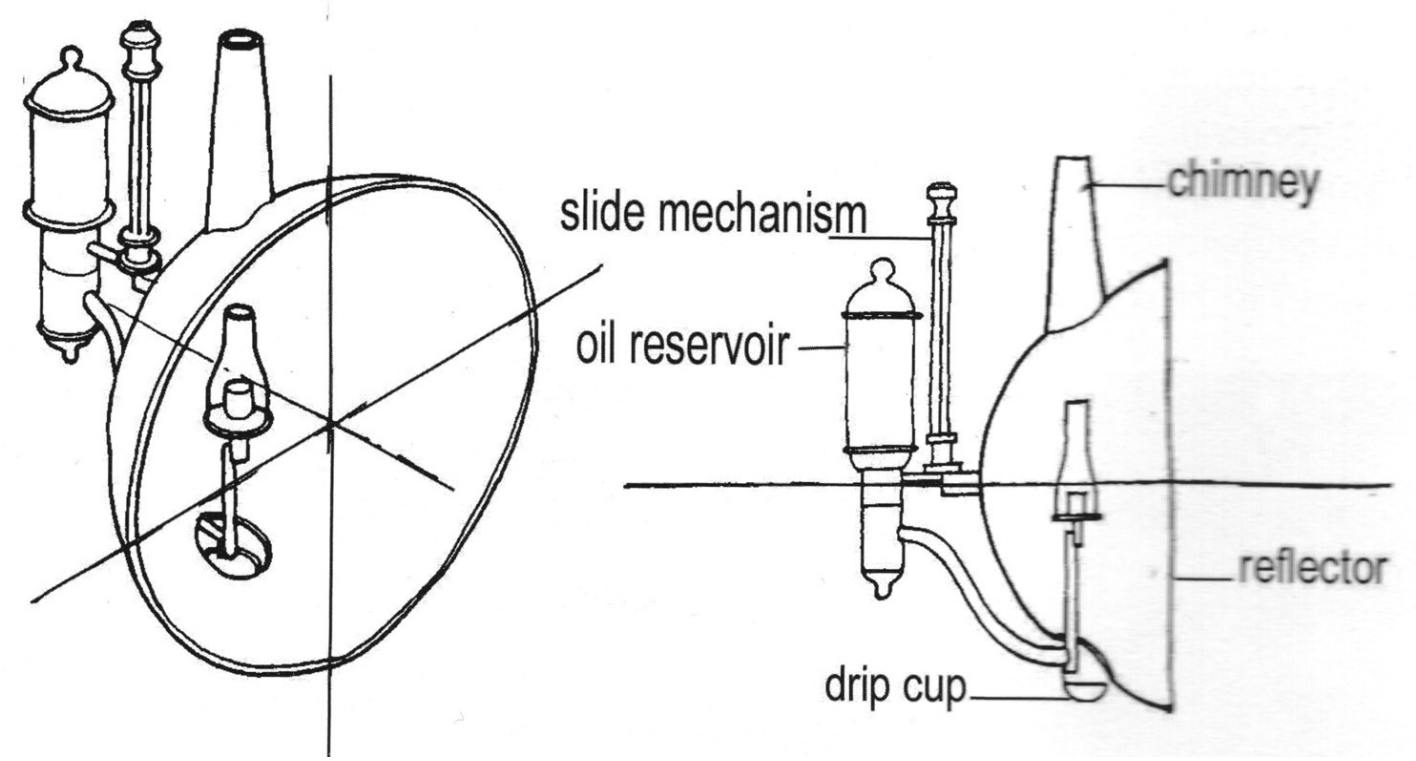


Figure 1A-03: Drawing of the Argand/Lewis lamp system with parabolic reflector used in U.S. lighthouses prior to the introduction of the Fresnel lens.

version was inferior in quality, Fifth Auditor Stephen Pleasonton adopted them as the U.S. standard and they were subsequently installed in all U.S. lighthouses prior to 1852.

Fresnel Lens

One of the significant changes implemented by the Lighthouse Board shortly following its 1852 inception was a mandate for the installation of Fresnel lenses in all lighthouses throughout the United States. The Fresnel lens, which had been invented by the French engineer Augustin Fresnel in 1822, had long been used in Europe and was known to provide much better illumination than the Lewis/Argand system used in the United States. The invention of this lens was a significant technical improvement in the history of lighthouses. The Fresnel lens system projected light from a single source through a set of rigid lenses that were set at a focal plane of light. The design of this lens system caused all the light rays that were emitted to bend parallel to the horizon sending greater light out to sea. Fresnel lenses were typically manufactured in France, with some also made in Great Britain. These lenses were dismantled for shipping across the Atlantic and reassembled once inside a U.S. lighthouse lantern room. One American company, Macbeth-Evans, produced a limited quantity of smaller fourth and fifth order Fresnel lenses for the USLHS from 1910 to 1932.[12] These lenses were used in range lights and lightships.

There are six sizes of Fresnel lenses, referred to as orders (Figure 1A-04). The orders range from one to six, with a first order being the largest (6′ diameter, 12′ tall) and providing the most illumination and a sixth order being the smallest (1′ diameter, 18″ tall). District engineers were responsible for determining the order of the lens that would be installed at each lighthouse. This decision was based on location of the light station and subsequent intensity and distance projection required by the light. Traditional beehive and barrel-shaped Fresnel lenses were installed in U.S. Lighthouses through the early twentieth century.

Figure 1A-04: Visual comparison of the six orders (sizes) of Fresnel lenses.

Modern Lenses

Beginning in the 1980s and continuing through today, the USCG began installing modern lenses fabricated of acrylic or plastic (Figure 1A-05). One of the more common types in use is a variable rotating beacon (VRB).

> The VRB-25 is a lighthouse optical system designed and built by Vega Industries Ltd. in Porirua, New Zealand. It was originally designed in 1993-95 with the assistance of the United States Coast Guard to meet USCG requirements for a robust mechanism requiring minimum maintenance. It has become the Coast Guard's standard 12 volt rotating beacon.[16]

Figure 1A-06 is a photo of a six-sided VRB-25 previously installed in the DeTour Reef Light. More recently, the USCG has been installing Vega LED Beacons (VLB). These lenses are much smaller, provide intense light, and require minimal maintenance (Figure 1A-07). While virtually all of the maritime illumination manufacturers now offer LED lighting systems, the Coast Guard appears to have narrowed its focus on two major manufacturers of LED lights, conducting extensive field testing of units produced by Vega Industries and Carmanah Technologies.[17]

Light and Beacon Characteristics

Lighthouses were, and continue to be, assigned unique characteristics to distinguish them from one another to mariners. Different characteristics included fixed, revolving, pulsating and colored lights. These characteristics were created through several means, including rotating the lens between opaque panels, referred to as flash panels, colored chimneys around the flame, and colored screens. There is a standard abbreviation system for light characteristics that are utilized in Broadcast Notices to Mariners, Local Notices to Mariners, on charts and in the Light Lists.[18]

FOG SIGNAL DEVELOPMENT

Audio warnings to aid mariners were developed concurrently with advances in lighthouse technology. In cases of fog and smoke, both of which were common throughout the Great Lakes, audio signals took over from the lights as the guiding instrument for mariners. The first fog signals in the United States were cannons (or fog guns) utilized at a few light stations on the east and west coasts, including the country's first station in Boston.[19] The use of these guns was short-lived due to the danger of operating them, the length of intervals between successive explosions and the brief duration of the sound.

Figure 1A-05: 2003 photo of Coastguardsmen holding the replacement optic for the St. Joseph Outer Light.

Figure 1A-07: Photo of the VLB44R-2.5-2T light by Vega Industries currently installed in the North Manitou Shoal Light Station.

Figure 1A-06: Photo of the six-sided VRB-25 previously installed at DeTour Reef Lighthouse.

The next type of signal consistently used in this country was large bells. These bells were initially manually struck. Later signals were actuated by mechanically operated bell strikers that were powered by descending weights, compressed gas or electricity. Due to their reliability, fog bells with automated bell strikers were used well into the twentieth century often times as a backup signal to later devices.

Several versions of fog whistles and trumpets were developed in the nineteenth century. These utilized locomotive whistles or reed trumpets (similar to a vibrating clarinet reed on a larger scale) that produced sound by compressed air or steam emitted through a circumferential slot in a cylindrical bell chamber. The compressed air versions were powered by hand, horsepower or steam.

Another sound signal that arose during this period of experimentation was the siren. It was first tested in 1867 and installed at New Jersey's Sandy Hook East Beacon in 1868. Originally this signal consisted of a large cast-iron trumpet. In the mouthpiece of the trumpet, a slotted revolving disc, or plate, was placed on a fixed slotted disc (seat). A slotted disc valve was placed on the back of the seated disc, which produced the characteristic of the sound. The chamber containing the discs was directly affixed to the steam dome of the boiler. About seventy pounds of steam was forced through the fixed and rotating discs and the interruptions of the jets of steam produced the note. Eventually, the disc type of siren was replaced by a rotation cylinder with peripheral slots (called the rotor) placed inside a casing, also with slots (termed the stator).[20]

By 1870, the trumpet, whistle, bell and siren had become standard fog signals. Because the bell had poor resonance and carrying power, it was not effective at coastal locations where wind would dampen the signal. Coastal stations received the steam whistle or siren; the reed horn trumpet was installed at less exposed locations and bells were used in areas with bays, estuaries and along rivers.[21] By 1900, there were 377 fog signals, exclusive of those on buoys, around the country with steam-powered whistles being the most common in use on the Great Lakes.

By the 1930s, many of these whistles were replaced with air diaphone systems. Air diaphone systems produced sound by means of a slotted reciprocating piston actuated by compressed air. The two most common diaphones used at light stations were the standard diaphone (gave a full steady upper tone that terminated in a heavy "grunt" tone) and the classic two-tone diaphone (produced an upper tone followed by a full steady low tone of equal or greater duration than the upper tone).[22]

Diaphones ranged in size and function from the tiny single tone Type "A" to the "Standard" units (Types "C-C" through the huge Type "L"), which produced a high tone that terminated in a heavy descending "grunt" tone, to the classic two-tone Type "F-2-T" foghorn.[23] Air diaphone systems were recognizable by the large resonators (commonly referred to as horns) that protruded out of the fog signal building or lighthouse tower and emitted the sound. Long, flared horns oriented horizontally were more commonly used as they provided maximum audibility in a specific direction (typically the direction of the most used shipping lane). Vertically mounted mushroom resonators were also used in some locations. These provided sound in all directions of the compass.[24]

As was the case with the light at each station, each fog signal had its own particular characteristic that distinguished it from other fog signals. Throughout the evolution of the systems, each was set up to sound-out a pattern of blasts and silence unique to that station. This enabled mariners to help pinpoint their location in thick weather from the unique sounds around them. It was also common to install duplicate fog signal equipment at each location. If one piece of machinery failed or was under repair, the duplicate system could be put into operation to keep the audio warning functioning.

BIG SABLE LIGHT STATION STATISTICS

ILLUMINATION

Characteristic:

Fixed White Light entirety of its operation

Lenses:

1867 – 1985	Third Order Fresnel Lens
1985 – 2015	300 mm plastic lens
2015 – Present	LEXAN polycarbonate LED lens

Lamps:

1867 – 1910	3-wick Frinck lamps
1910 – 1945	Incandescent Oil Vapor (IOV)
1945 – present	Electric bulbs

Stand-by light on lantern gallery: 1971 - unknown

FOG SIGNAL

1909 – 1934 Cylindrical, vertical air siren

Characteristic: 45-second cycle consisting of a blast of 3 seconds followed by a silent interval of 12 seconds, then another 3 second blast followed by 27 seconds of silence.

1934 – 1970 Type F, Two-tone Diaphones

Characteristic 1934 -1941: 60-second cycle consisting of a blast of 3 seconds followed by a silent interval of 12 seconds, then another 3 second blast followed by 42 seconds of silence

Characteristic 1941 -1970: 60-second cycle consisting of a blast of 3 seconds followed by a silent interval of 3 seconds, then another 3 second blast followed by 51 seconds of silence

OIL HOUSES

Cylindrical metal oil house: 1892 – 1920s

Small brick oil house (later used as paint locker):
1903 – at least 1978

Large brick oil house (later used for coal storage):
1910 – 1941

Figure 1A-08: Circa 1960s photo of the third order Fresnel lens.

Figure 1A-09: 2015 photo of the plastic lens being removed.

Figure 1A-10: 2023 photo of the current LED lens.

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16. "VRB-25," Wikipedia, https://en.wikipedia.org/wiki/VRB-25," accessed January 20, 2020.

17. Pepper, Terry, "Vega VLB-36 & VLB-48 LED Beacons," Seeing the Light: Vega VLB-36, http://www.terrypepper.com/lights/closeups/illumination/led/index.htm, accessed January 20, 2020.

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Sable Points Lighthouse Keepers
Association

1B Historical Overview

The point of land projecting into Lake Michigan approximately nine miles north of Ludington was originally referred to as Grande Pointe au Sable by French explorers and traders. Review of historic documentation indicates that the Federal Government first surveyed this area in 1838. By the 1850s, Grande Pointe au Sable had become a prominent landmark for mariners traveling along this often-treacherous stretch of the lake. "According to Captain Neils C. Palmer, who for many years was officer in charge of the Ludington Coast Guard Station, the blackest year in maritime history for the Ludington area was 1855, when several ships, including the schooners Samuel Strong, G. W. Weeks, and Almina, were wrecked with significant loss of life."[1]

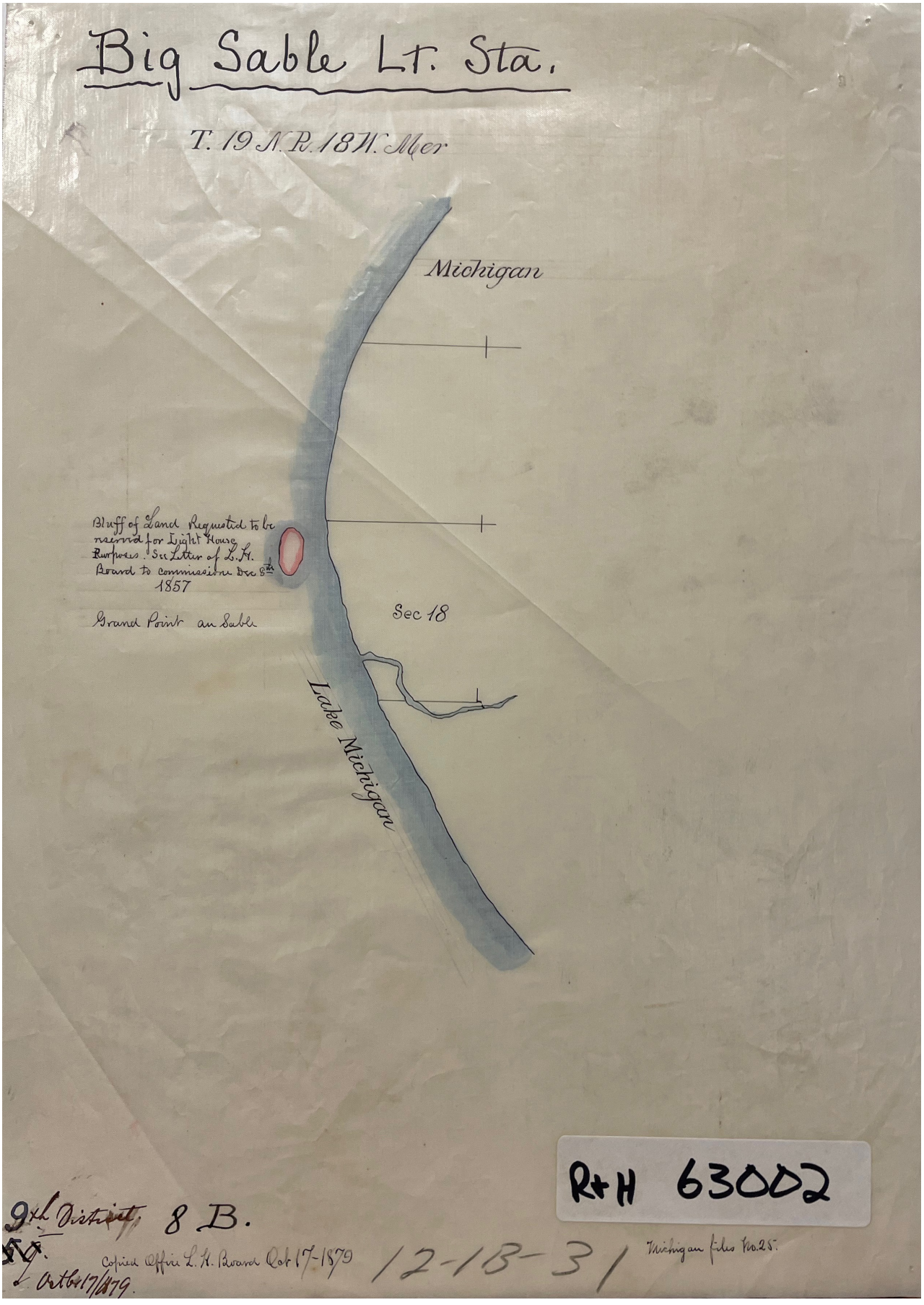

Figure 1B-01: 1879 drawing in the Lighthouse Board files showing the original area of land requested for the lighthouse.

Congress appropriated $6,000 in August of 1856 "for a lake-coast light at Grand Point Au Sable[2], Lake Michigan, State Michigan."[3] Historic documents differ as to when President Buchanan reserved land for the lighthouse. Some documents indicate that a parcel of land was initially reserved in 1856, with additional land secured in 1858; other documents only reference 1858. This initial land reservation was referred to as a "bluff of land" and a "sand bank" on historic documents and appears as a small island just offshore on historic drawings (Figure 1B-01). An Index of United States Lighthouse Establishment (USLHE) correspondence from November 1857 reveals that Henry Lapaute of Paris, France fabricated, shipped and invoiced for a fourth order Fresnel lens for the lighthouse. The actual correspondence has not been located, so the cost and other detailsof this lens are currently unknown.

While funding was secured, land reserved, and a lens made ready, only $881.46 were spent. The rest of the funding was returned to the Congressional surplus fund in 1859. It is not known why the lighthouse was not built nor why the money was returned. There has been commentary that it was because it was needed in the government coffers to help fund the Civil War.[4] It is also not currently known whether the Fresnel lens was returned to the fabricator or installed at another lighthouse.

Although a lighthouse was not built, the need for it remained. Commerce linked to the burgeoning lumber industry required that the point be suitably lighted. The 1865 Lighthouse Board Annual Report stated, "The most salient point on the eastern shore of Lake Michigan, between Point Betsey and Muskegon, is known

as Grand Pointe au Sable, and is unmarked by night. It is a principal landmark for day navigation, and it would seem that the interests of commerce demand that it be suitably lighted. A special estimate is submitted."[5] State Senator Charles Mears also pressed the legislature to ask the federal government for a light station at Big Sable. In response to this, Congress appropriated $35,000 in July 1866 for a lighthouse on the point. Additional land was reserved by the President in October, bringing the size of the lighthouse reservation to 933 acres. This land was deeded to the federal government by the State of Michigan.

Construction of the lighthouse – a tower attached to a keeper's dwelling by an enclosed passageway – was completed in 1867. Review of the "Statement of Appropriations, &c." from March 4, 1789, to June 30, 1882" published in 1886 indicates that the full $35,000 in funding was spent. Very little has been located regarding construction drawings or specifications, limited to correspondence that references drawings that had been prepared and a few drawings of details for the tower (Figures 1B-02, 1B-03 and 1B-04). These drawings were utilized for multiple light towers. Although the drawings are not signed, the configuration and details of the light tower are signature elements of the Lighthouse Board's chief Engineer, Orlando Poe (see sidebar on page 38).

The tower, passageway and keeper's dwelling were all built of yellow brick on stone foundations. This is likely Milwaukee "Cream City" brick. Milwaukee had a brick-making boom in the mid to late nineteenth century, with several brickyards fabricating bricks from local clay found along the western shore of Lake Michigan.

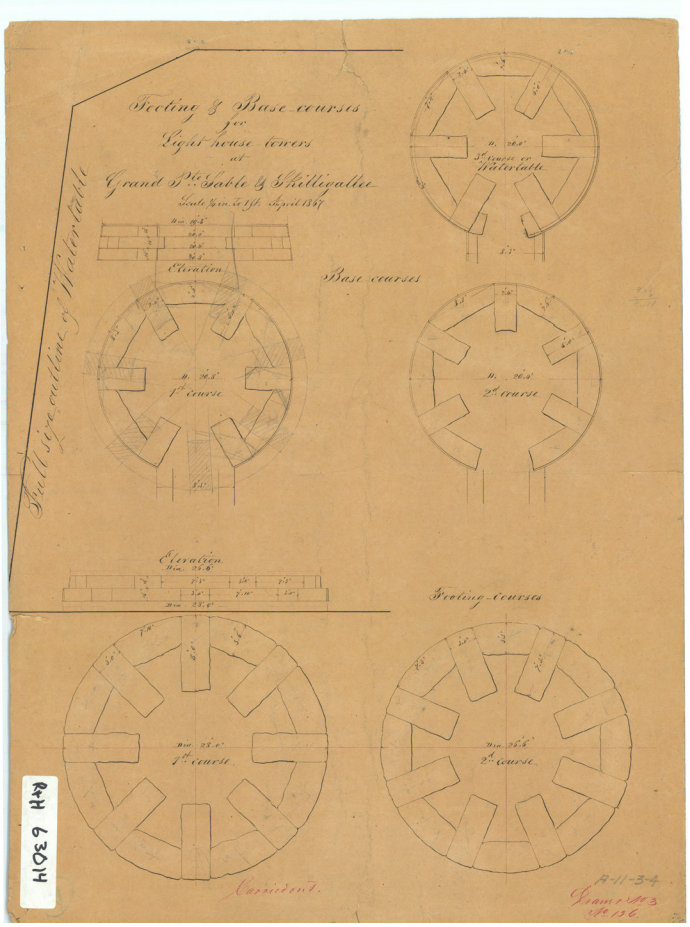

Figure 1B-02: April 1867 drawing for the "Footing & Base-courses for Lighthouse-towers at Grand Pte. Sable & Skilligallee."

This brick was shipped and used throughout the Midwest, including at many light stations.

"With the Lighthouse Depot in Milwaukee responsible for the construction of Lake Michigan's remote lighthouses, it is understandable that construction supplies were purchased locally and shipped via lighthouse tender to the remote building sites. Thus, when the Milwaukee Depot's masons were assigned to build a new station, bricks were purchased from Milwaukee's brickyards, and thus cream city bricks were used."[6]

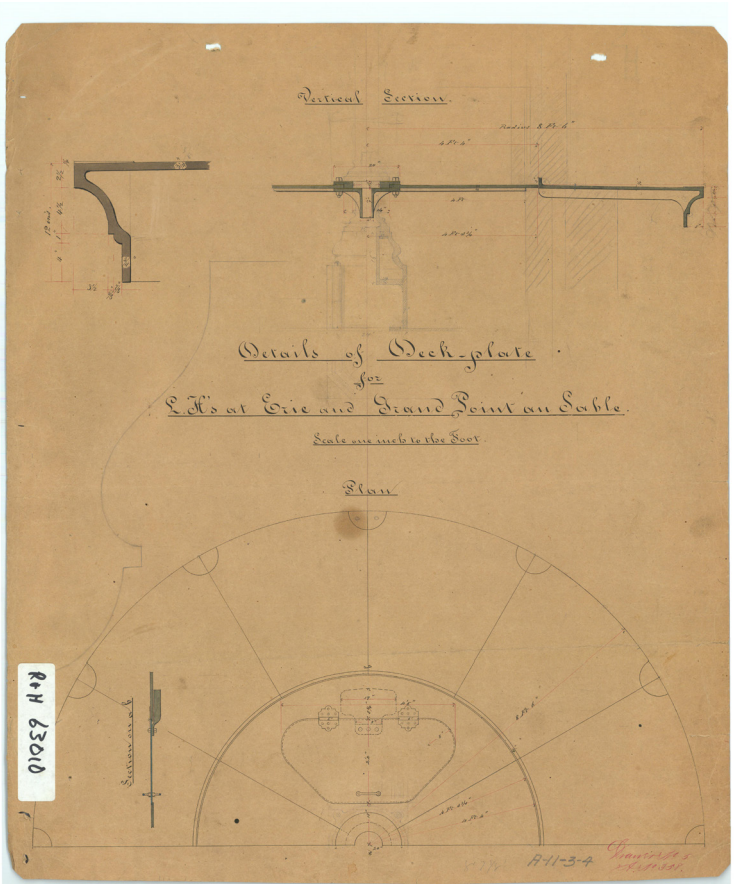

Figure 1B-03: Circa 1867 drawing for "Details of Deck-plate for L.H's at Erie and Grand Point au Sable."

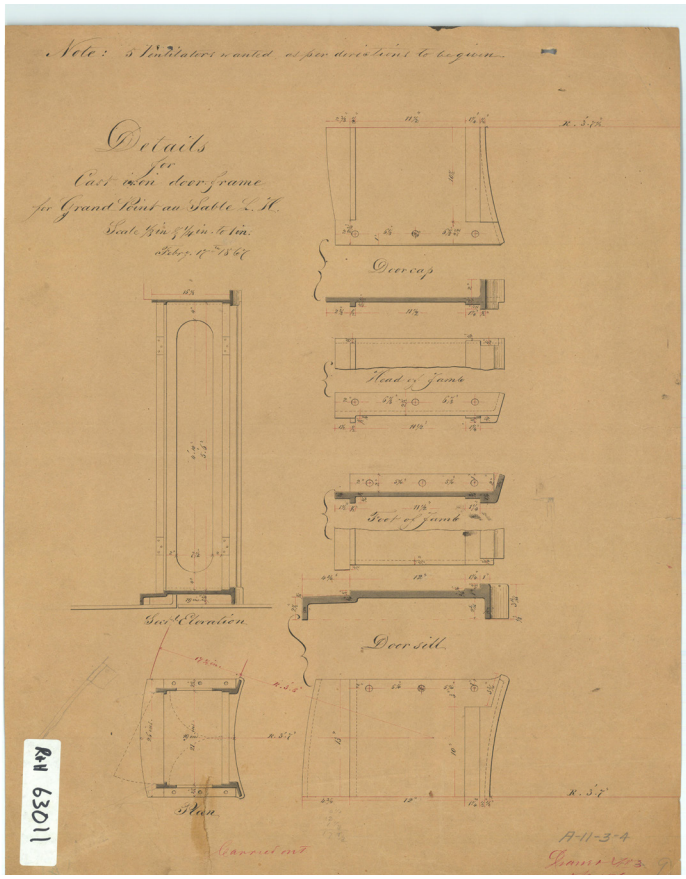

Figure 1B-04: February 1867 drawing for the "Details for Cast iron door frame for Grand Point au Sable L.H."

The main portion of the Keepers' Dwelling was 1-1/2 stories, with a basement under half of it. The main entrance was at the west gable end, facing the lake (Figure 1B-06). A single-story, shed-style roof section extended from the east side (Figure 1B-16). This simple design was used at many light stations during the 1860s – 1870s (Figure 1B-07). There were four rooms on both the first and second stories. Based on review of later drawings of the dwelling, as well as those of the similar dwelling at Thunder Bay Island Light Station, the first-floor layout comprised a kitchen, living room, office, and oil (for the lantern) and wood (for the wood-burning stoves) storage rooms. It is unclear if the second-floor rooms were all used as bedrooms or if there was a separate kitchen and living room for the assistant keeper. The latter is more likely, as it provides separate living spaces, especially if the keeper and/or the assistant had family living with them.

Figure 1B-06: 1900 photograph looking east at the keeper's dwelling.

ORLANDO M. POE

Orlando Poe was a First Lieutenant working on the U.S. Lake Survey before the Civil War began. During the Civil War, Poe served as the chief engineer to Major General William T. Sherman during which he oversaw the burning of Atlanta. He directly supervised the dismantling of all buildings and structures in Atlanta that could have provided any military value to the Rebel Army once Sherman abandoned the city; rail depots, roundhouses, arsenals and storage areas were manually disassembled and the combustible materials then destroyed by controlled fires.[1] After the war, he was awarded the honorary rank of Brevet Brigadier General, although his regular Army rank was Major.

In 1865, with the war over, Poe became Engineer Secretary of the Lighthouse Board and supervised building projects. By 1870, he was promoted to Chief Engineer of the Upper Great Lakes 11th Lighthouse District. He held that job for only three years before leaving to rejoin William T. Sherman as his aide-de-camp.[2] In 1883, Poe returned to the 11th District as Superintending Engineer of improvement of rivers and harbors on Lakes Superior and Huron. During this time he designed the first Poe Lock for the Soo Locks in Sault Ste. Marie.[3] Completed in 1896, less than a year after Poe died from an infection due to an injury he sustained while on-duty at the Soo Lock, the Poe lock was the largest in the world and was instrumental in the success of Great Lakes shipping.[4]

In his capacity as a lighthouse engineer, Orlando Poe was largely responsible for the design of a style of lighthouse tower for land-based stations that has become known as the "Poe style" tower. These towers are all tall brick structures, with a gentle taper from bottom to top. All of the Poe-designed towers feature graceful embellishments in the form of masonry gallery support corbels and arch topped windows, which are exemplified by the towers at South Manitou Island (Figure 1B-05) and Presque Isle in Michigan. Poe was responsible for the construction of a number of such towers throughout Lakes Superior, Michigan and Huron.

Figure 1B-05: Undated photo of South Manitou Island Light Station showing the signature "Poe style" light tower

Resources:

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Figure 1B-07: 2017 photo of the similar keeper's dwelling (built 1868) at Thunder Bay Island Light Station.

An index of USLHE correspondence indicates that the Fresnel lens was installed and the lighthouse keeper and assistant keeper were selected in the fall of 1867. The third-order Fresnel lens was fabricated by Louis Sautter & Company of Paris, France (Figure 1B-08). According to the Port of Ludington Maritime Museum, this was the second-largest lens installed at a Lake Michigan lighthouse. The Lighthouse Board Annual Report stated that the station "was lighted for the first time on the night of November 1, 1867."[7] Alonzo Hyde, Sr. was appointed as the first keeper.

Figure 1B-08: 2023 photo of the restored, Big Sable third-order Fresnel lens, located at The Port of Ludington Maritime Museum.

Just one year later, the Lighthouse Board Annual Report stated that though the new station was new and in good condition, "The drifting of the sand threatens the stability of the tower."[8] This concern was also noted the following year - the 1889 report noted that, "The sand about the foundation needs close attention to avoid a similar occurrence to that reported at Point Betsey." A copy of a former researcher's notes on this report, located in the SPLKA archives, includes: "(The Point Betsie lighthouse foundation eroded and the floors within the dwelling and tower began to crumble and the plaster on the walls and ceilings cracked. Major rebuilding occurred in 1868 - 1869.)" While the 1880 report noted that, "The tower was repointed, the dwelling was overhauled and repaired, and the station left in good condition," it did not mention a concern with drifting sand.

The station was surveyed for the USLHE in June of 1883 (Figure 1B-09). The survey shows the boundary of the 933-acre lighthouse reservation. The mean high and low water lines are also shown, as well as the U.S. Life-Saving Station approximately 1-1/2 miles south of

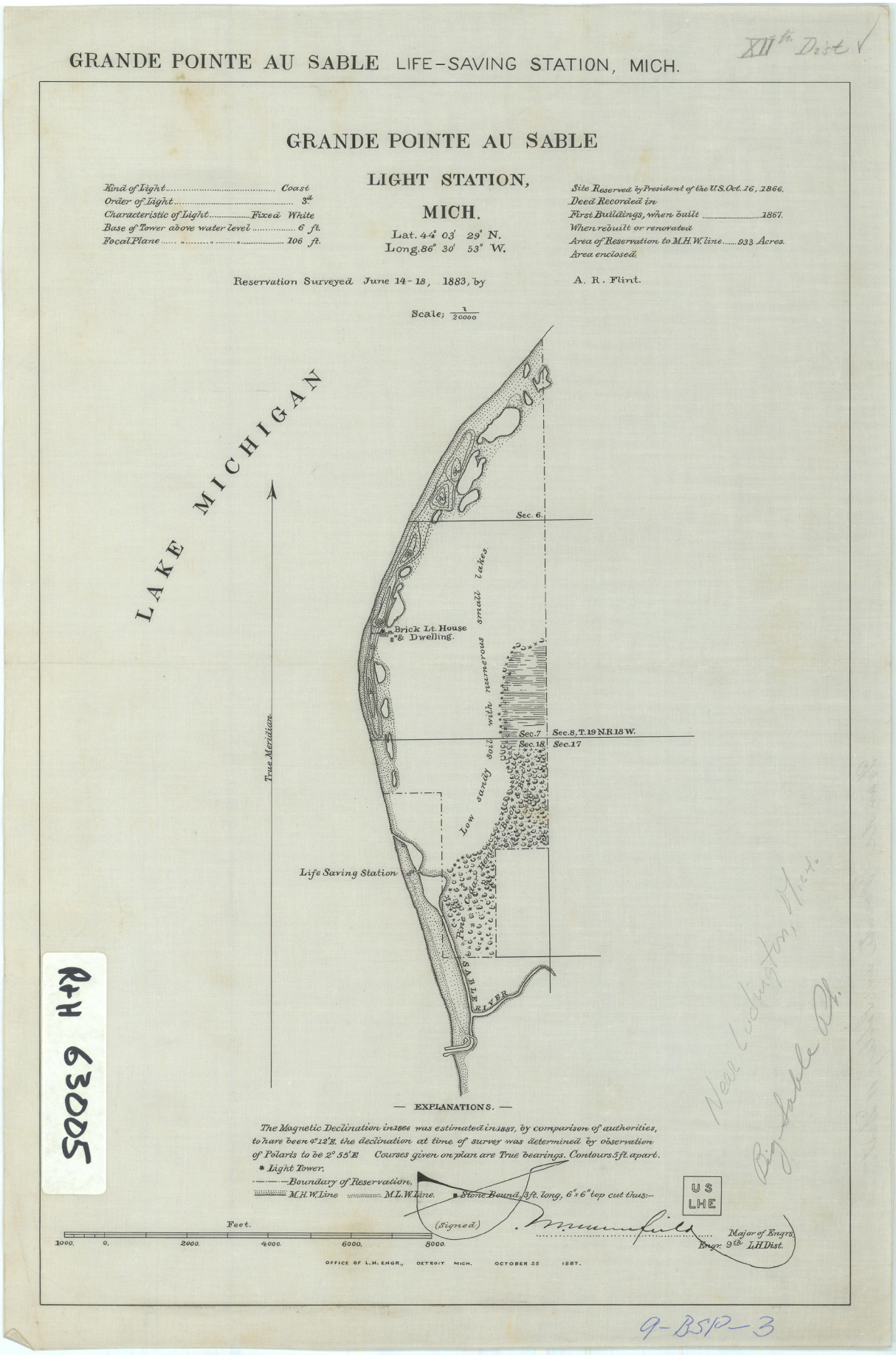

Figure 1B-09: Site plan based on the 1883 survey of the light station. The original "sand bank" island that appeared on earlier drawings, was not shown on any drawings following this survey. Comparison of drawings indicates that the shoreline had shifted and/or the water level was lower, resulting in the island merging with the mainland.

the light station. The survey indicates that the land was "low sandy soil with numerous small lakes" and a large area of pine, cedar, hemlock, beech and birch trees at the southeast portion of the reservation. Four outbuildings are shown on the survey drawing (Figure 1B-10). Review of later photographs and drawings reveals that these were all storage buildings, referred to as both barns and sheds. In his book "Big Sable Lighthouse," Thomas A. Tag indicates that one of these was a temporary building built for supply storage and construction crew housing during the initial construction of the station, and that it was left at the station for later use as a barn (see later Figure 1B-16). Figure 1B-15 shows two of the large outbuildings southeast of the keeper's dwelling. The wood cribbing with elevated wood walks around the keeper's dwelling, and wood walks extending east and west from the dwelling are also depicted on the survey drawing (and in Figure 1B-15).

Fuel was a topic of correspondence in the late 1880s – early 1890s. The index of USLHE correspondence from 1886-1887 indicates that stoves and coal for burning in them were authorized for the tower watchroom. The 1890 Annual Lighthouse Board report stated that an oil house was "urgently needed." In 1892, nine circular iron oil houses were delivered and installed at light stations in the Ninth District, including at Grande Pointe au Sable. The oil house had a 360 gallon capacity and was erected 106 feet south of the light tower.[9] That same year, Lighthouse Keeper Tomas Bailey requested to build a small boathouse at his own expense. There was no road access to the station at that time, it was only accessible by boat or on foot along the beach from Ludington. Although the Lighthouse District Engineer recommended that the request be granted, it is not known if the boathouse was built. It does not appear on any drawings or later photos, and the 1909 USLHE description of the station states that there was no boathouse at that time. A new well was driven and what was noted as "various repairs" in the annual report were made in 1892.

An 1897 map of the navigational aids in the Ninth Lighthouse District indicates Big Sable[10] as an important light on Lake Michigan (Figure 1B-11). Starting that year, there was correspondence regarding the visibility of the light tower to mariners during the day. The yellow buff color of the brick blended in with the surrounding sand dunes, making it hard to recognize. A Navy Commander wrote to the Lighthouse Board in October 1897, "Sirs: I would respectfully recommend a change of color of painting in the following named Lights, so as to make them better day marks: … Grande Pointe au Sable, to be painted white, with black bands. It is almost the color of sand."[11] Another letter in July 1898 from the Ninth District Lighthouse Inspector to the Lighthouse Board repeated the plea, "I recommend that the color of the towers at the following sites be changed that the towers may be made better day-marks: … Grande Pointe au Sable, to be painted white with a black stripe or vertical bars painted black and white."[12] There are no photographs of the tower from this period, nor has any documentation been located that the tower was painted.

An 1898 inspection revealed that the tower was in poor condition and other repairs were needed at the station. The lighthouse engineer who carried out the inspection wrote to the Lighthouse Board that, "Repointing and cement-washing are much needed in the near future."[13] He also noted that the revetment and raised wood plank walk around the dwelling and the plaster in the passageway needed "renewal." The 1899 Annual Lighthouse Board report stated that "the timber platform around the tower and dwelling was rebuilt."[14] However, the plan for addressing the deteriorated brick on the tower

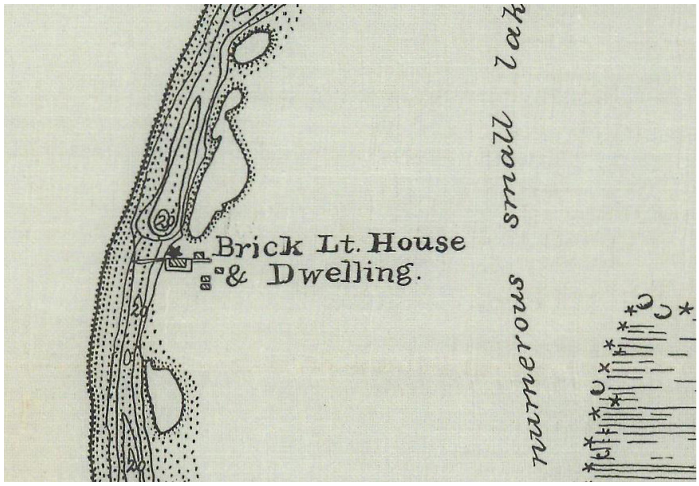

Figure 1B-10: Detail of the 1883 survey drawing showing the buildings and wood walks at the station.

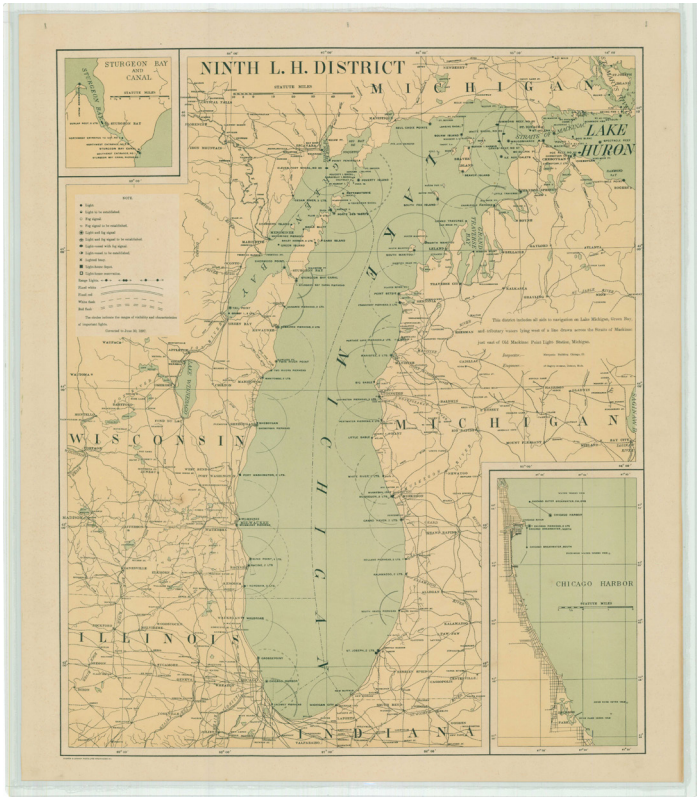

Figure 1B-11: 1897 map pf the navigational aids in the Ninth Lighthouse District.

changed. Instead of repairing and repointing the brick, the tower was encased with metal plates:

> According to letter to the Light House Board dated April 15, 1899, relative to tower at Big Sable Light Station, Mich., it was stated that the tower was in bad shape owing to leakage and cracks in the brick work and that if some such method of protection such as encasing with metal was not adopted the tower would become so bad that it would require rebuilding or replacing entirely by a new tower. The proposed remedy suggested was to enclose the tower with a series of vertical metal bands joined horizontally with steel angles riveted to the plates and bolted when erected in place. As the metal work was put in place the space in between it and the tower was filled with fine concrete.[15]

Figures 1B-12 and 1B-13 are drawings for the metal encasement. Note that the metal casing only extended to the watchroom floor level. The Lighthouse Board informed the Secretary of the Treasury that the project was advertised for bids in the fall and five bids were received:

> The Board has the honor to state that bids were invited by posters and circular letters for furnishing metal casing for the tower at the Grande Pointe au Sable, Mich., Light-Station.
>
> In response five bids were received, a schedule of which is enclosed. These bids were publicly opened at the office of the Engineer of the 9th Light-House District on 20 Nov., '99, that being the date fixed therefor [sic] in the advertisement.
>
> The bid of the J.G. Wagner Co., of Milwaukee, Wis., in the sum of $3,225, is the lowest of those received, and is reasonable, advantageous to the Government, and not in excess of current market rates.
>
> Recommendation is therefore made that this bid be accepted for the sum stated therein, and that the Board be authorized to enter into contract in accordance therewith.[16]

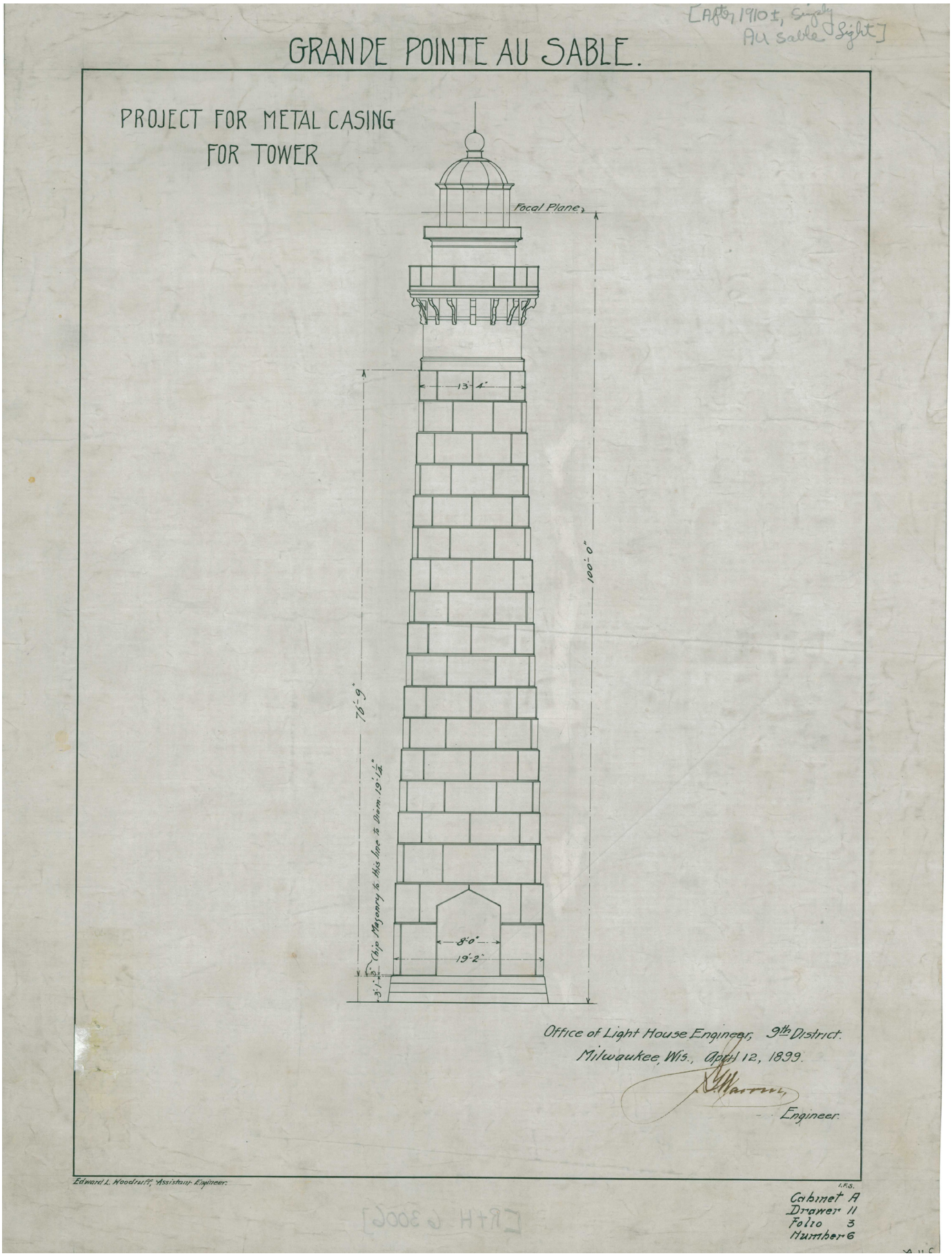

Figure 1B-12: April 1899 drawing for the metal casing for the tower.

The District Engineer also informed the Lighthouse Board that J.G. Wagner Company was known to be responsible. Wagner's bid was accepted in late November and they were issued a contract in December 1899. It was realized in January 1900 that the windows were not included in the scope of work. The District Engineer wrote to the Lighthouse Board, "no provisions were made at the time for windows, which it was intended should be cut into the metal at the time of erection. It is believed that a better window, and more thoroughly waterproof, will be obtained by inserting circular windows with metal frames."[17] Bids were solicited from three firms in Detroit, Cleveland and Milwaukee. The five windows were purchased from the lowest bidder, Hoffmann & Billings Mfg. Co. of Milwaukee. By March, the J.G. Wagner Company was well underway pre-fabricating the metal casing sections in their shops. Bids were solicited from seventeen firms in April for furnishing related materials for the project, including cement, crushed stone, paint, lumber, hardware, coal and other provisions. These were purchased from different firms, based on material, for a total cost of $399.00. The Lighthouse Board Annual Report indicated that the work was completed in June:

> The metal work was completely constructed, erected in the shops and inspected, and was delivered, and the work was completed in June. The work of encasing the tower consisted of covering the entire shaft of the tower with a series of 18 metal cylinders, each cylinder stepping back from the one immediately preceding. The cylinders were reenforced [sic] top and bottom by steel angles riveted to the plates, and vertical steel angles at the joints of the plates forming each cylinder. The space inside of these cylinders was filled with concrete as the work progressed, making one entire mass of the whole work. This novel construction, which was adopted to avoid building a new tower, or more extensive repairs, will prevent leakage and the disintegration of the brick work.[18]

Figure 1B-14 is a photo of the construction crew upon completion of the metal encasement. Once the metalwork was complete, the tower was painted white and black as had been previously recommended (Figures 1B-15, 1B-16 and 1B-17). The tower at Cana Island, Wisconsin was similarly encased the same year. This work successfully protected the towers, as the District Inspector wrote to the Commissioner of Lighthouses several years later, "At the last inspection of Big Sable Light Station on October 5, 1911, and Cana Island on October 27, 1911, the towers were in good condition and showed no indication of leakage; this indicates that the metal casing has proved satisfactory for the purposes intended."[19]

A small brick oil house was built at the station in 1903 (Figure 1B-17). Drawings were prepared in 1904 to extend the metal cladding around the watchroom level up to the underside of the lantern gallery (Figure 1B-18). This work was completed in 1905. The 1905 Lighthouse Board Annual Report stated that, "A steel watch-room deck was placed in the upper portion of the tower and the base of the tower was also repaired" that year.[20]

By 1908, mariners had been expressing the need for a fog signal at this station, and the Lighthouse Board recommended a fog signal building be built. The House of Representatives Committee on Interstate and Foreign Commerce agreed. The following letter from the committee chairman was attached to approved House Bill 15936 to fund the fog signal:

> DEAR SIR: This Department has the honor to acknowledge the receipt of the committee's letter of February 1, 1908, inclosing copy of H.R. 15936, "to authorize the establishment of a fog signal at Grand Point au Sable, Michigan, on Lake Michigan," and asking that the committee be furnished with such suggestions as may be deemed proper touching the merits of the bill and the propriety of its passage.

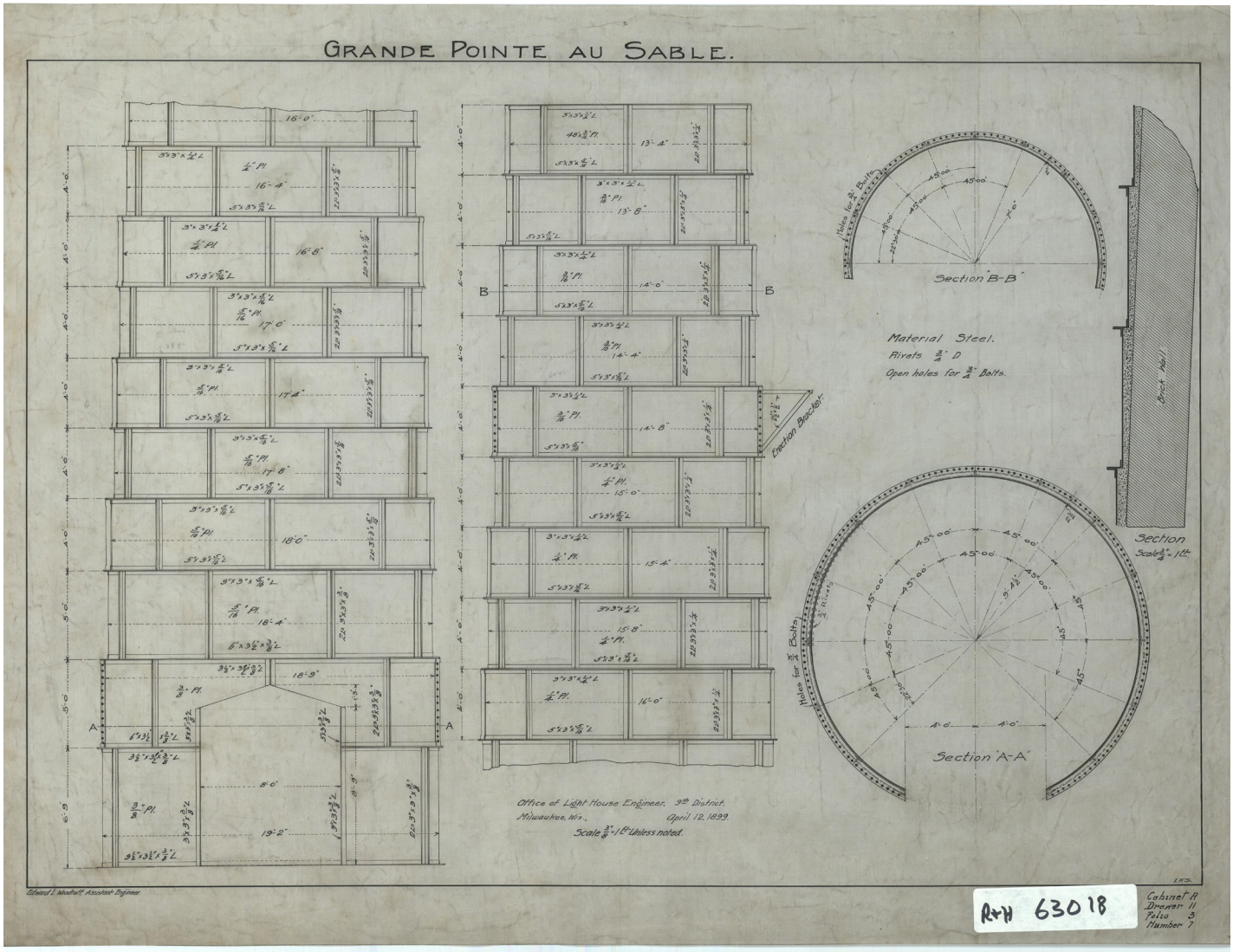

Figure 1B-13: April 1899 drawing for the metal casing for the tower.

Figure 1B-14: 1900 photograph of the construction crew that encased the tower in metal plates.

Figure 1B-15: 1900 photograph looking east at the new metal plating at the tower being painted. The raised wood walks and two of the sheds/barns at the station can also be seen in this photo.

Figure 1B-16: 1900 photograph looking west at the new metal plating at the tower being painted. The roof of the one-story portion of the keeper's dwelling and the barn that may have housed the original construction crew can also be seen in this photo.

Figure 1B-17: Circa 1903-1905 photograph looking northeast at the station. The newly encased and painted tower and the new brick oil house can be seen.

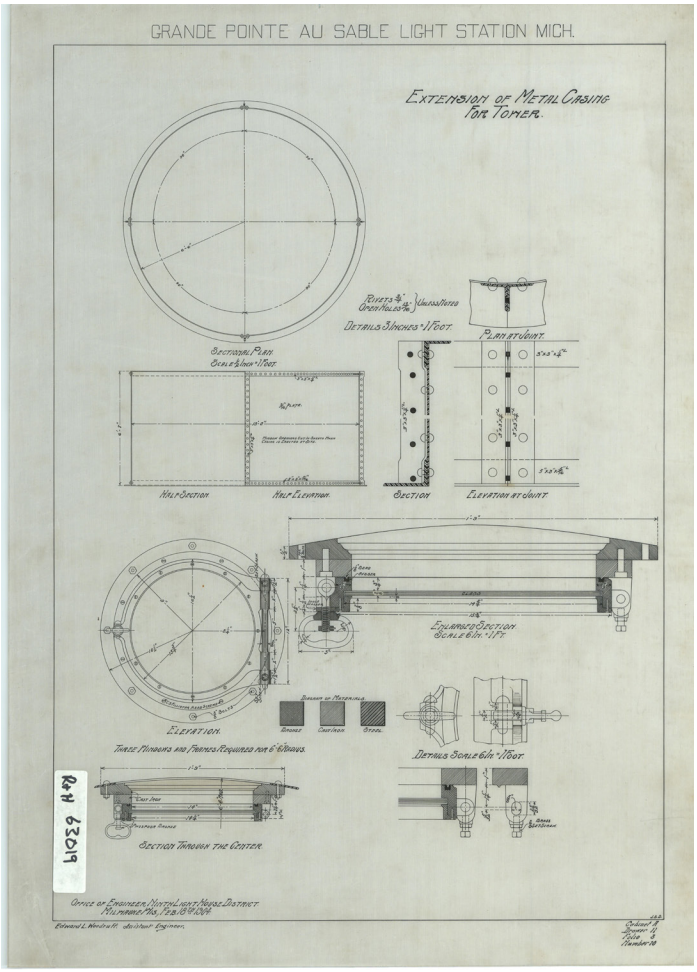

Figure 1B-18: 1904 drawings for extension of the metal cladding and circular, porthole-style windows at the tower watchroom level.

Figure 1B-19: 1909 photograph of the recently completed fog signal building. The recently expanded keeper's dwelling can also been seen in the background.

The Light-House Board, to which the matter was referred, states that vessels bound from the Straits of Mackinac to Chicago, or South Chicago, or vice versa, take a straight course from or to Point Betsie, leaving a narrow margin when passing abreast of Big Point Sable.

The signals at Manistee and Ludington pierheads, being in deep bays, one on each side of this point, are naturally ineffective in conveying to vessels information as to their distance off the point.

The number of vessels bound through has increased materially in late years, and in a short time there will be a further increase by reason of extensive growth of business to be expected at South Chicago, Ill., and Gary, Ind.

Mariners are making strenuous complaints as to the absence of a fog signal at Grand Point au Sable, and the Light-House Board is strongly impressed with the need of immediately establishing one.

This Department therefore, concurring in the views expressed above, recommends the passage of the bill.

The fog signal building was constructed in 1908 – 1909 and put into operation on May 20, 1909. Figure 1B-19 is a photo of the recently completed building. The building was brick, with a concrete floor and red asbestos roof shingles. The Lighthouse Annual Report stated that the fog signal equipment consisted of two 22-horsepower kerosene oil engines with compressors and air tanks, and a first class automatic compressed-air siren. A copy of a former researcher's notes of the annual report, located in the SPLKA archives, says that the total cost was $10,048.00. The Fairbanks, Morse & Company of Chicago furnished the oil engines at a cost of $3,030.00.[21] All parts of the fog signal machinery and equipment were provided in duplicate, with exception of the air storage tanks and trumpet. The six-foot-long copper trumpet component of the air siren was made by A.W.F. Brown. A Crosby Automatic timing device was furnished from the General Depot

at Tompkinsville, New York. The fog signal's characteristic was set to provide a repeated 45-second cycle consisting of a blast of 3 seconds followed by a silent interval of 12 seconds, then another 3 second blast followed by 27 seconds of silence. The 12th District Inspector reported in 1912 that, "This aid to navigation has proved satisfactory at this point and with the present installation the keepers are able to sound the signal immediately when fog appears."[22]

The addition of a fog signal added to the lighthouse keeper's workload, and a second assistant keeper was assigned to the station. Drawings were prepared in 1908 to expand the keeper's dwelling to accommodate three keepers (Figures 1B-20 through 1B-24). Construction was complete by the summer of 1909. The one-story portion was removed and a two-story addition was added at the east side of the dwelling. Dormers were added in the original second floor to provide more usable floor space. A similar yellow brick was used at the addition. The upper portion of the east gable and the sides of the dormers were clad with wood shingles. The lighthouse keeper's residence comprised both the first and second floors of the original portion of the dwelling. The northwest room that was originally used for oil storage before the oil houses were built, now served as an office. The first floor of the addition was the assistant keeper's residence, and the second floor was for the second assistant keeper. Each keeper was assigned a cellar area in the basement. A stair was added in the unexcavated area under the keeper's residence to provide access to his cellar area. The addition included an interior stair to the assistant keeper's cellar. There was a bulkhead exterior stair (outside cellarway) on the east side of the addition that provided access to the second assistant keeper's cellar.

Four porches were added – one at the original, west entrance to the keeper's residence; one at the new entrance on the south side of the dwelling that led to a stair and was the second assistant keeper's entrance; and one at the east side of the addition that was the assistant keeper's entrance. A rear porch was also added on the north side of the building, with a door leading to it from the keeper's residence. The porches were built on brick foundations and the walls were clad in wood shingles. The wood cribbing and walks were also extended around the addition. Several upgrades were also made to the existing portion of the dwelling. New roof shingles were installed on the entire building, as well as new galvanized iron ridging, finials, gutters and downspouts. The latter tied into a new cistern. All of the window sashes were replaced and new stone window sills were installed at the second floor, west windows. Figures 1B-25 and 1B-26 show the keepers' dwelling soon after the expansion.

A detailed written description of the light station was prepared in 1909. This standard "DESCRIPTION OF BUILDINGS, PREMISES, EQUIPMENT, ETC." was completed by the Lighthouse Establishment at many Great Lakes stations in 1909 and 1910. A note at the beginning of the form states, "This Form is designed mainly to guide in preparing accurate descriptions of new light-stations, but will be used also in describing those that have been long established, when required, and especially when changes have been made at a station which affect the replies to the questions herein."[23] It is appropriate that this would have been prepared for this station, given the addition of the fog signal and expansion of the keepers' dwelling. This description states that the area of the entire site was 857.72 acres; smaller than the 933 acres

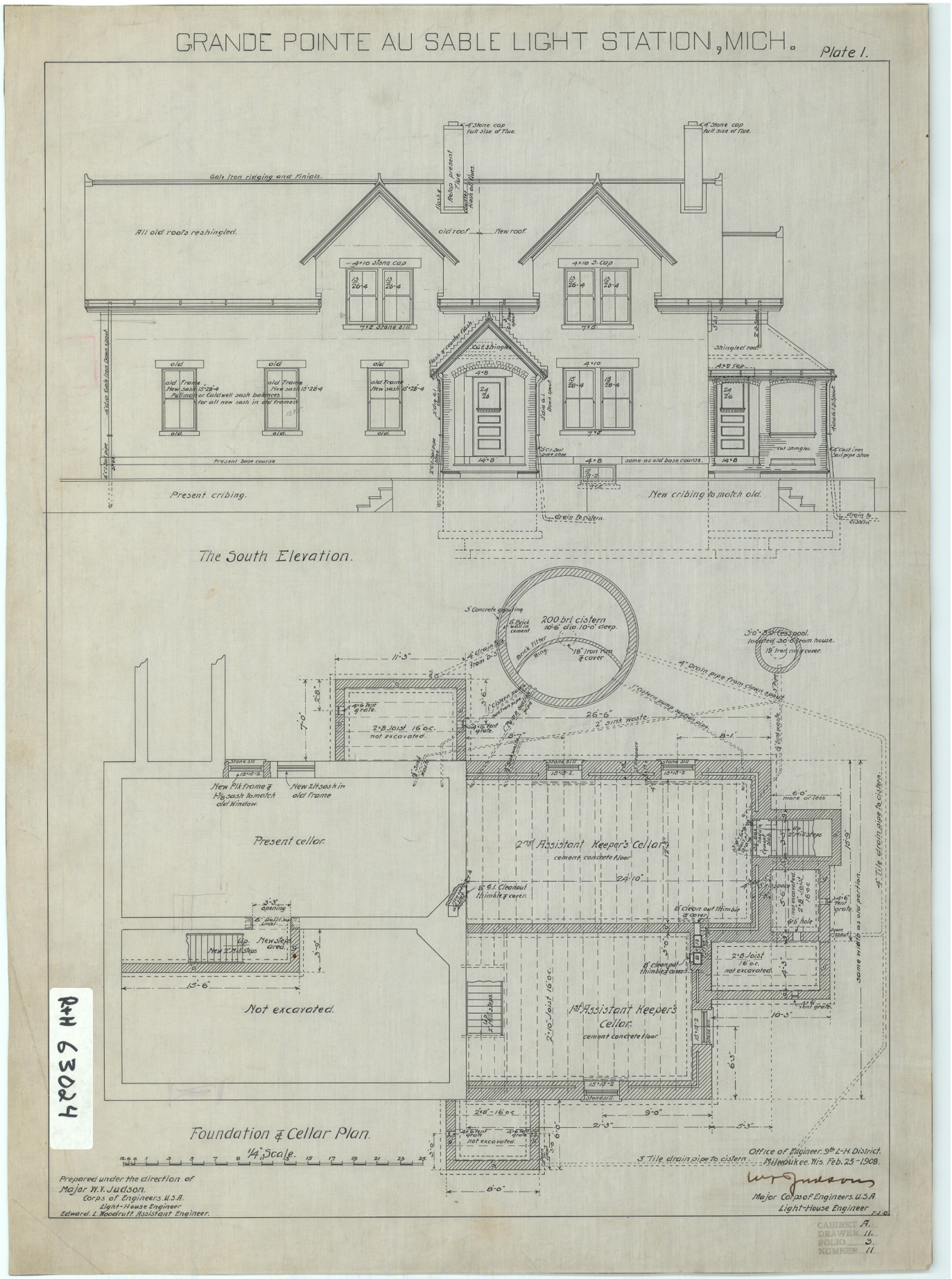

Figure 1B-20: 1908 drawing for the extension to and modifications of the keeper's dwelling. This drawing includes the south elevation and the foundation and cellar plan.

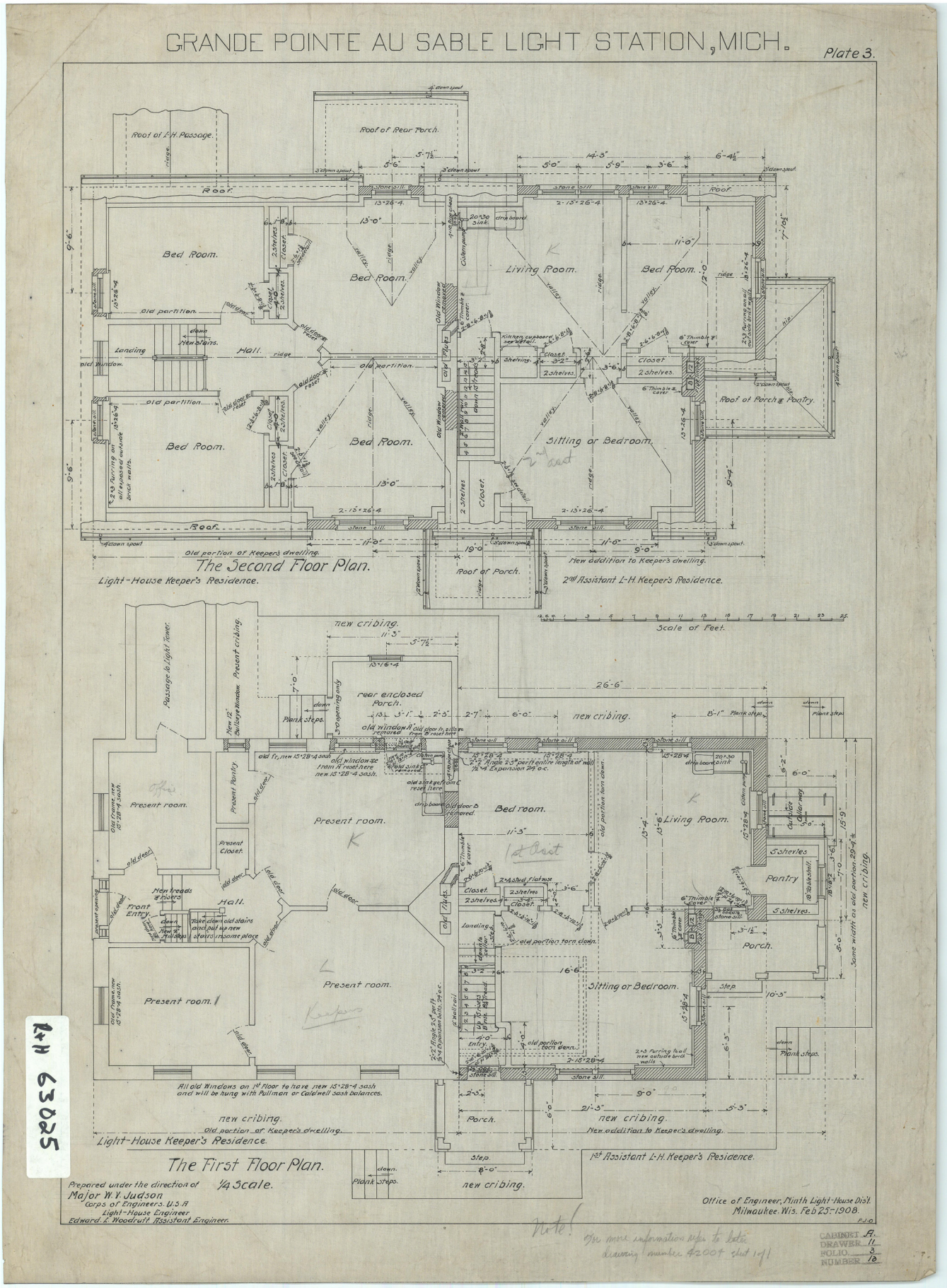

Figure 1B-22: 1908 drawing for the extension to and modifications of the keeper's dwelling. This drawing includes the first and second floor plans.

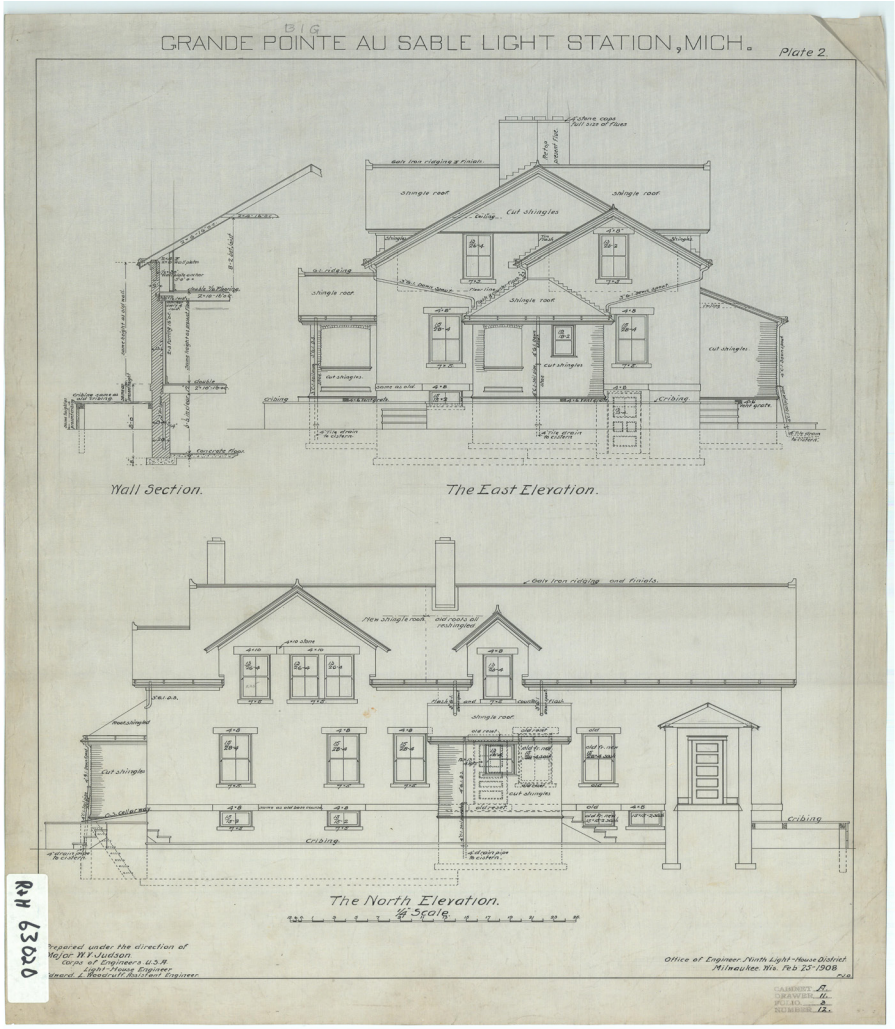

Figure 1B-21: 1908 drawing for the extension to and modifications of the keeper's dwelling. This drawing includes the east and north elevations.

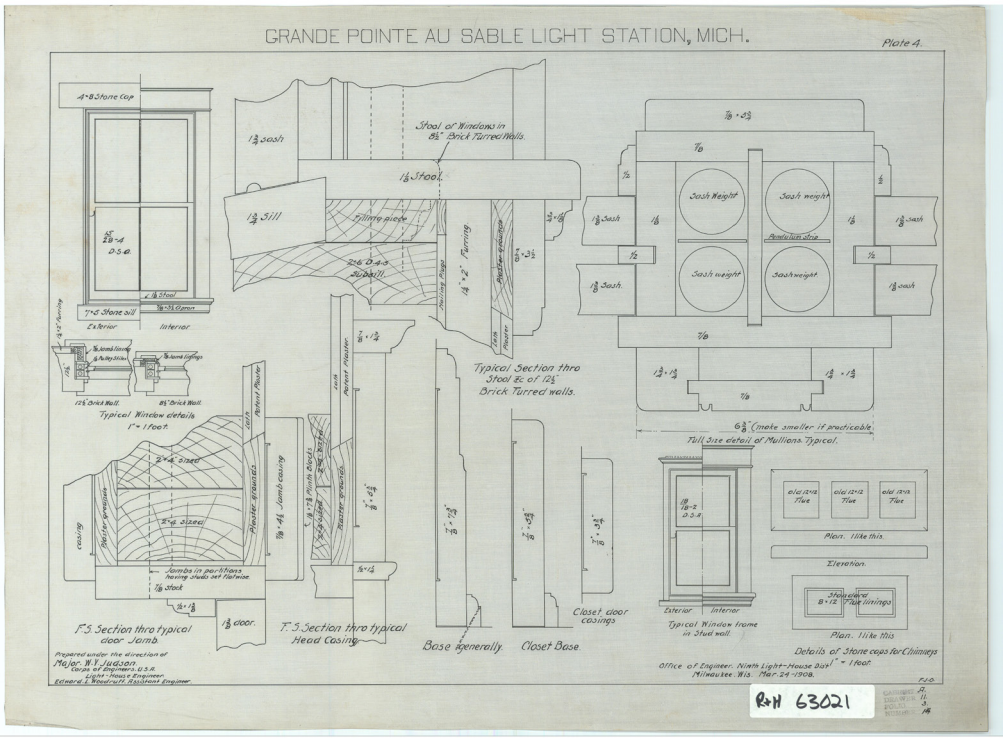

Figure 1B-23: 1908 drawing for the extension to and modifications of the keeper's dwelling. This drawing includes details for the windows, millwork and new stone chimney caps.

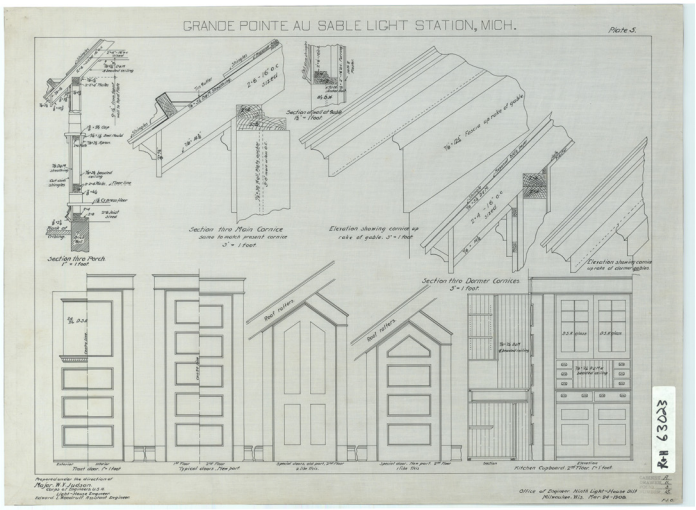

Figure 1B-24: 1908 drawing for the extension to and modifications of the keeper's dwelling. This drawing includes details for the porches, cornices, doors, and kitchen cupboards.

Figure 1B-25: 1910 photograph looking northeast toward the recently expanded keeper's dwelling.

Figure 1B-26: 1910 photograph looking southwest toward the recently expanded keeper's dwelling.

stated on the 1883 survey. The reason for this discrepancy is not currently known. The tower was noted as being 385 feet from the high-water mark at that time. There was still no road access to the station. The description stated that the station, "may be reached by driving along beach from Ludington or by boat from Ludington in fair weather." The fog signal building had been built relatively close to the shoreline and there was concern with the shifting sand almost immediately following its construction. The 1909 USLHE description of the station stated, "The sand around fog-signal building has blown away until there is over 6 ft of foundation of building exposed, the rest of grounds are as good as could be expected, considering that the soil is shifting yellow sand. The foundation of F.S. Bld'g will be protected by suitable means."[24]

A site plan showing the station buildings was prepared and accompanied the narrative description (Figure 1B-27). This drawing shows the wood walks around the dwelling and site, and that a four-foot-wide concrete walk had been built around the base of the tower. The fog signal building is shown, along with the well east of it. The description noted that there were four wells in total, "one drive well inside of fog-signal building for lavatory purposes and one encased well outside; for dwellings, two driven wells, north and south of buildings; quantity is ample for the station at all seasons of the year; 1-1/4" driven wells with water obtained by pumps." The brick and metal oil houses are shown southwest of the dwelling, as well as a brick privy east of it. Three of the four sheds that appeared on the 1883 survey are still present. The two larger sheds southeast of the dwelling are noted in the description as a "bronze green double shed," and that the smaller east of the dwelling was a frame structure painted white. The lighthouse reservation survey drawing was also updated to reflect the current buildings (Figure 1B-28). Figure 1B-29 is a 1914 photo of the station.

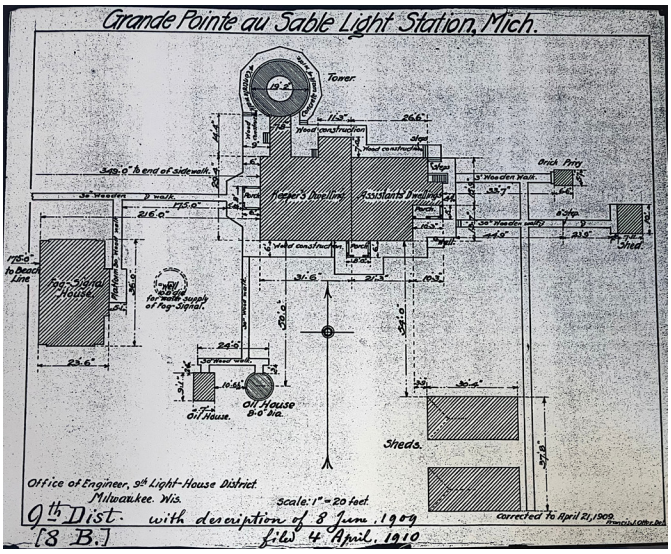

Figure 1B-27: 1909 site plan drawing included with the USLHE description of the station.

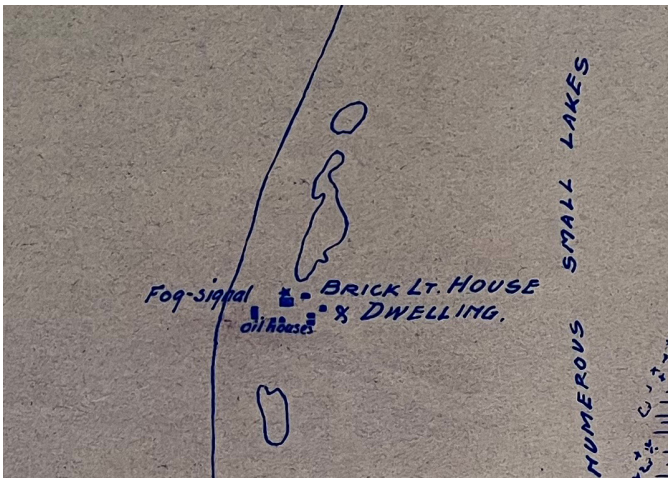

Figure 1B-28: Updated lighthouse reservation survey drawing based on 1909 description of the station.

Figure 1B-29: 1914 photograph looking northeast at the station.

The illuminating apparatus in the Third Order lens was upgraded from a kerosene-fueled lamp to a more efficient incandescent oil vapor (IOV) system in 1910 (Figure 1B-30). The name of the station was also officially changed that year. A letter from the Naval Secretary to the Secretary of Commerce and Labor explained the reason for this, "Sir: The board has the honor to invite attention to page 36 of the third report of the U.S. Board on Geographic Names, in which the spelling of Grande Pointe au Sable is changed to Big Sable, and recommends that the title of Grande Pointe au Sable Light-station, Michigan, be changed to Big Sable Light-Station, Michigan."[25] At the same time, the name of a light station located on Lake Superior that had been previously named Big Sable Light Station was changed to Au Sable Light Station. Another development in 1910 was the construction of a large, brick oil house adjacent to the fog signal building (Figures 1B-31 and 1B-35).

The limited access to the isolated station came up again when the 12th District Inspector submitted a request to build a horse barn on the site. The form read:

> This is to be a frame barn 20' x 36' x 12'0" to plate shell only. The keepers to erect interior partition and stalls. This station is very isolated, being nine miles from nearest harbor, and route is along a very exposed coast and dangerous to use motor boat for considerable period of year, especially during fall, winter and early spring. The Asst. Keeper has a horse and outfit, but very inadequate means of taking care of them, and it is recommended that authority be granted to erect this structure.[26]

A 1914 photograph reveals that the other barns located east and southeast of the dwelling, which could have been used as a horse barn, were gone by this time (Figure 1B-32). (It is not currently known when or why they were removed.) The request form was stamped as authorized on September 25, 1913. What was likely this small barn appears in a circa 1915 photograph (Figure 1B-33) and in a later 1919 photograph (Figure 1B-34). Although the request form stated that it was dangerous to use a motorboat most of the year, historic photographs reveal that a boathouse had been built between the fog signal building and the shoreline between 1910 and 1914 (Figures 1B-34 and 1B-35).

The visibility of the tower as a daymark for mariners was addressed again in 1916. The 12th District Inspector submitted a request to improve the visibility through painting the lantern black. The form stated:

> From seaward the lantern is above the low background of sand dunes and trees, and in bright weather the top of tower merges into the sky and does not stand out clearly; it is recommended to remedy this defect to paint black the following features of lantern and upper portion of tower: The cornice and roof of lantern; the cornice and balustrade of lantern deck; the cornice of tower, the brackets under the cornice and the balustrade around parapet deck.[27]

The Lighthouse Bureau approved the request in September. The District Inspector also submitted another request in 1916 for repairs and upgrades at the station. These included replacing the doors and concrete floor at the fog signal building and replacing the wood plank walks around the keepers' dwelling and grounds

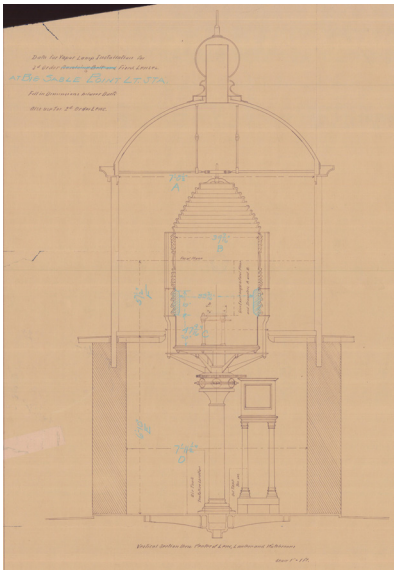

Figure 1B-30: April 1909 drawing for vapor lamp installation in third order fixed lenses with dimensions added for the lens at Big Sable.

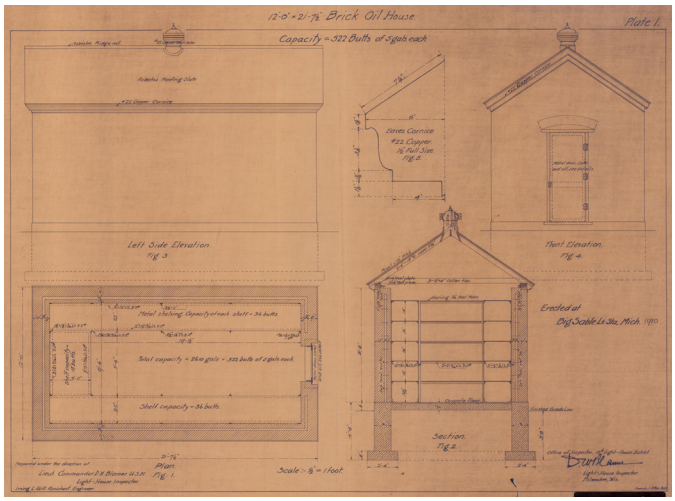

Figure 1B-31: Undated drawing for a large oil house, noted as erected at Big Sable Light Station in 1910.

Figure 1B-32: 1914 photograph looking northeast toward the lighthouse and oil houses. The three barns east and southeast of the dwelling appear to have been removed from the site by this time.

Figure 1B-33: Circa 1915 looking southeast toward the lighthouse. The small white building beyond is likely a small horse barn built in 1913-1914.

Figure 1B-34: June 1919 photograph looking east toward the station from the water.

Figure 1B-35: 1914 photograph looking north toward the boathouse and large brick oil house.

with concrete walks. Although this work was approved, another form submitted in 1919 states:

> Expenditures for materials were made in the amount of $260.37 but no work was executed. Owing to changed conditions it is necessary to carry out the repairs authorized previously in a more substantial manner, in order to insure the safety of the structures and the cost of work is also much greater. Other repairs, not covered by the previous authority are now found necessary. It is, therefore, requested that the authority of March 30, 1916 be now cancelled and that this Form 80 be now approved, in order to consolidate the whole work under a single authority.[28]

The new work request included several additional repairs, which were noted as "urgent in order to restore decayed and deteriorated portions of structures and prevent rapid further deterioration and destruction and make the living conditions proper from a sanitary standpoint." The repairs, completed in 1920, included:

- Tower: Provide support under lantern watch room floor at top of stair column which has settled.
- Grounds: Remove all the present decayed plank walks and construct an entire new system of reinforced concrete walks for entire station. Temporary repairs to plank walls, pending entire completion of concrete walks, after fill is made in spring, 1920.
- Dwelling
  - -Provide coal storage for all three keepers in cellar by constructing outside cellarway and window for filling
  - -Renew 10 decayed window sash and provide 5 new storm sash
  - -Fill up cesspool which is close to dwelling and is a nuisance and is not able to take

care of sewage from 3 kitchens and construct small septic tank and sewage disposal duct

-Remove old brick privy which stands close to dwelling and construct new frame privy

-Tear down and remove old disruptable [sic] looking shed from yard, (now used for coal storage)

• Fog Signal Building

-Renew Concrete Floor: The present concrete floor has settled badly, due to the jarring down of the sand filling beneath, under the vibration action of the Fairbanks Morse Oil Engines. The walls are spreading and the building will rapidly go to destruction unless walls are tied together. It is proposed to remove the old concrete floor and place a new reinforced concrete floor 4" thick supported by 5 reinforced T beams, 12" x 18". The ends of the beams to go thru the foundation walls and the reinforcing rods to also serve as tie rods, using 8" channel iron bearing plates as "washers" on outside of wall.

-Replace Entrance Doors

-Storm House Entrance - Replace 1 Pr. decayed window sash and supply 6 new large storm sash and 3 small storm sash and 6 window screens

-Construct Platform on roof and ladder for access to air screen [may be typo for siren]

-Provide for coal storage in oil house adjacent to Fog Signal

-Make fill about fog signal and grade grounds - This is necessary to protect foundation of fog signal from further deterioration. It is also necessary in order that grounds may be safe and present a proper appearance. "sand Grass" will be planted on the surface of the sand fill and maintained until roots are started by watering. NOTE: The sand fill may be delayed to FY 1921 if necessary, because of lack of funds FY 1920.

Repairs and upgrades at the station in the 1920s included the installation of two oil tanks on concrete saddles south of the fog signal building in 1924; telephone service to the station in 1925 (Figure 1B-36); and a new, large flagpole on a concrete base, also in 1925 (Figure 1B-37). In 1926, it was determined that a large portion of the lighthouse reservation "cannot be profitably used in the work of the Lighthouse Service."[29] In May, Congress approved that, "the Secretary of Commerce was authorized to convey the said tract or parcel of land to the State of Michigan for public park purposes." The 800 acres of land was deeded to the state with a requirement that the state build and maintain a road to the station:

> Provided that the State of Michigan shall provide and maintain, for vehicles and personnel of the United States Government, free and convenient access to the light station and Coast Guard station, and shall make and maintain such road or roads of access and such changes, repairs, or improvements thereto, as the Secretary of Commerce may hereafter deem necessary, and shall maintain easements for beams of light for any lights that may be maintained by the United States.

Following the land conveyance, the size of the lighthouse reservation was approximately 30 acres. The road was officially dedicated in 1928 and the Michigan Department of Conservation constructed it in 1932-33. Other items of note at

Figure 1B-36: Circa 1920s photograph looking northeast toward the lighthouse. Note the telephone pole west of the passageway.

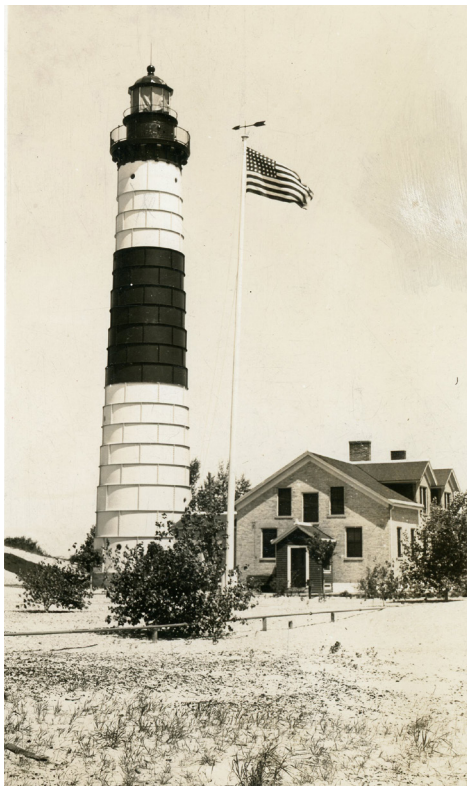

Figure 1B-37: Circa 1920s photograph looking northeast toward the lighthouse, with the large new flagpole.

Figure 1B-38: Circa 1930s photo of the fog signal building and boathouse, after the boathouse was moved southeast and fog signal was changed to a diaphone.

the station in the late 1920s included replastering the keeper's residence kitchen; construction of a new incline at the boathouse; and a new concrete driveway. The boathouse was moved southeast of its former location in 1929 (Figure 1B-38). This move was likely necessitated by the easterly movement of the shoreline (Figure 1B-39).

A government real estate form prepared in 1930 listed the buildings present at that time, as well as their appraised value. The form included the following buildings and values:

- Lighthouse (tower and dwelling) $23,374.69
- Brick fog signal building $4,266.50
- Frame boathouse $360.00
- Frame barn $398.35
- Steel plate circular oil house $268.46
- Large brick oil house $599.32
- Small brick oil house $288.88
- Brick privy $120
- Frame privy $115.20

In January 1934, 12th District Superintendent submitted a request to replace the fog signal equipment. The form noted its necessity: "Present A. & F. Brown Siren, cylindrical, vertical, with revolving part 4-23/64" wide, installed in 1908 is old and worn out and lacking in power for this important station. To be installed in housing or cupola - to be built on roof of Fog Signal Building."[30] The estimated cost was $1,200 for the equipment, building modifications, and labor to be funded through the National Industrial Recovery Act (NIRA). This NIRA funding also included providing electricity at five light stations, including Big Sable. The diaphone was

Figure 1B-39: Circa mid-late 1930s looking toward the station from the water.

installed in December of 1934. The fog signal's characteristic was set to provide a repeated 60-second cycle consisting of a blast of 3 seconds followed by a silent interval of 12 seconds, then another 3 second blast followed by 42 seconds of silence. Figures 1B-39 and 1B-40 show the fog signal building after the installation of the diaphone system.

Other work in the 1930s included rebuilding the boathouse foundation and replacing the telephone poles in 1938. The keepers' dwelling roof was replaced in 1939. Based on review of historic photos, the roof appears much darker after this (Figure 1B-41). The original wood shingles were likely replaced with black asphalt shingles. The keepers built a birdhouse for Martins in 1940 (Figure 1B-41). A Martin birdhouse appears in several photos after this, in different locations on the grounds. It is not known whether the same birdhouse was relocated or new ones built. The tower was also repainted in 1940 (Figure 1B-42), and the keeper's kitchen sink was replaced.

A very strong storm struck the area on November 12, 1940. The Lake Michigan car-ferry was beached and the Canadian ship Davrock sunk, among others, resulting in loss of life. The keepers patrolled the beach for days, first searching, then as a recovery effort. The storm also caused severe shoreline erosion. Several photos taken in January 1941 show the erosion dangerously close to the fog signal building and large oil house (Figures 1B-43 and 1B-44). The fog signal engine was replaced later in 1941. The erosion continued through the year and photos show that the large oil house had collapsed by November (Figures 1B-45 and 1B-46).

With concern that the fog signal building may also collapse, measures were undertaken to safely continue providing a fog signal to mariners. The boathouse was moved several yards east to a location south of the keepers' dwelling in November and later converted into a workshop and storage building. The

Figure 1B-40: Circa mid-late 1930s of the east side of the fog signal building.

Figure 1B-41: 1940 photograph looking east toward the lighthouse. Note the dark shingles and Martin birdhouse.

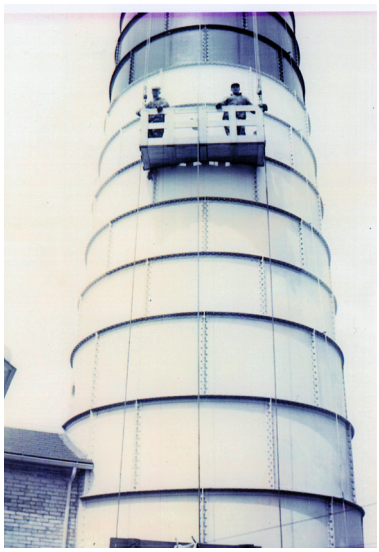

Figure 1B-42: 1940 photo of the tower being painted.

Figure 1B-43: January 1941 photo looking north toward the oil house, fog signal building, and boathouse.

Figure 1B-44: January 1941 photo looking north toward the oil house, fog signal building, and boathouse.

Figure 1B-45: November 1941 photo looking north, just west of the fog signal building. The foundation and debris from the oil house is in the background.

Figure 1B-46: November 1941 photo looking south toward the fog signal building. The foundation and debris from the oil house is in the foreground.

November 5th keeper's log entry states that, "A work crew arrived at the site to move the Boathouse to allow the construction of a new Diaphone Fog-Signal tower." Figures 1B-47 and 1B-48 show the boathouse being moved. The fog signal tower was built later in November (Figure 1B-49). The tower was located northeast of the fog signal building though, not in the former location of the boathouse (Figure 1B-50). A separate control building to house the fog signal equipment was built further east, near the lighthouse (Figure 1B-51). Figure 1B-52 is the construction drawing for the fog signal tower and control building.

Review of keeper's log entries from late 1941 and 1942 reveal that the original fog signal building collapsed in January of 1942:

- Nov 7, 1941 - Sea is washing in close to the old fog-signal. With a strong wind it is only about three feet away.
- Jan 1, 1942 - Storm is washing away the beach around the old fog-signal.
- Jan 2, 1942 - The sea is now washing the old fog-signal away.
- July 7, 1942 - Officer and men arrived to take down what's left of the old fog-signal.
- July 8, 1942 - Salvaging the bricks from the old fog-signal.
- July 13, 1942 - Salvage complete except for cleaning the bricks.
- Aug 3, 1942 - Burned the remainder of the old fog-signal wooden parts that were not worth salvaging.

Figures 1B-53 and 1B-54 show the remaining portions of the fallen structure in the water in 1943. The shoreline erosion continued throughout 1942 and 1943, threatening the stability of the new fog signal tower. Guy wires were installed in December 1942. Temporary timber shore protection was constructed around the tower in June of 1943 (Figure 1B-55). It was then backfilled with rock, stone and debris from the old fog signal building and had a brick and cement cap/platform (Figure 1B-56). By August, the brick and cement cap began collapsing at the northwest corner (Figure 1B-57). Steel sheet piling was then installed later in the fall along a greater length of the shore (Figures 1B-58 and 1B-59). Review of historic drawings and photographs indicates that rip rap was installed at the north and south ends of the steel seawall in 1944 to extend the length of shore protection.

Figure 1B-47: Photo of men installing timbers under the boathouse to move it.

Figure 1B-48: Photo looking north during relocation of the boathouse. The boathouse is in right side of the photo.

Figure 1B-49: Photo of the fog signal tower under construction.

Figure 1B-50: Photo of the fog signal tower under construction northeast of the fog signal building.

Figure 1B-51: Photo looking northeast toward the light tower and new fog signal control building.

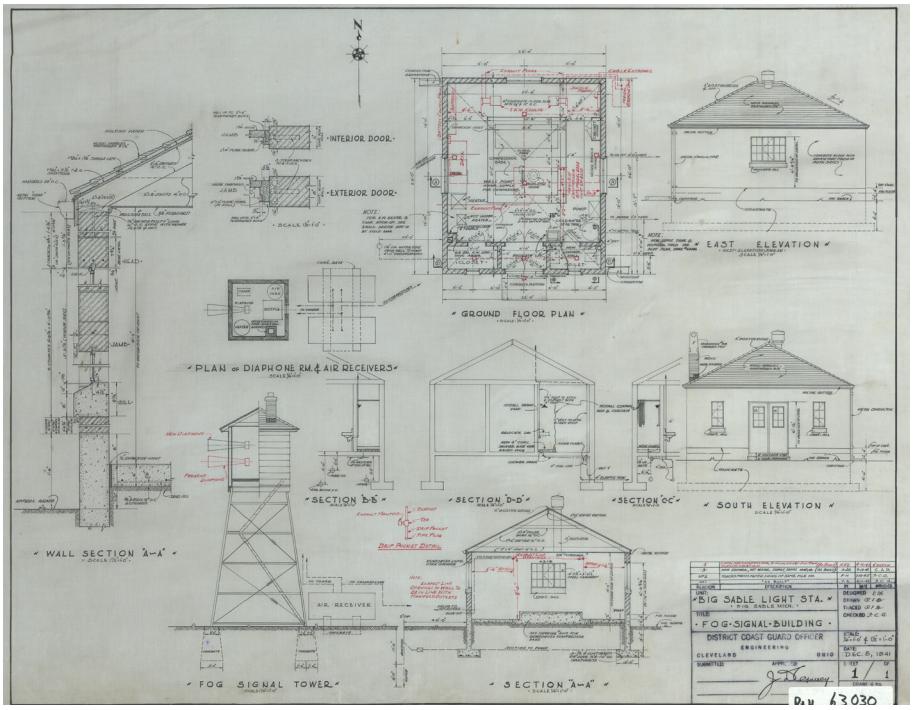

Figure 1B-52: Construction drawing for the fog signal tower and control building

Figure 1B-53: 1943 photo of the collapsed remaining portion of the fog signal building in the water.

Figure 1B-54: 1943 photo of the collapsed remaining portion of the fog signal building in the water.

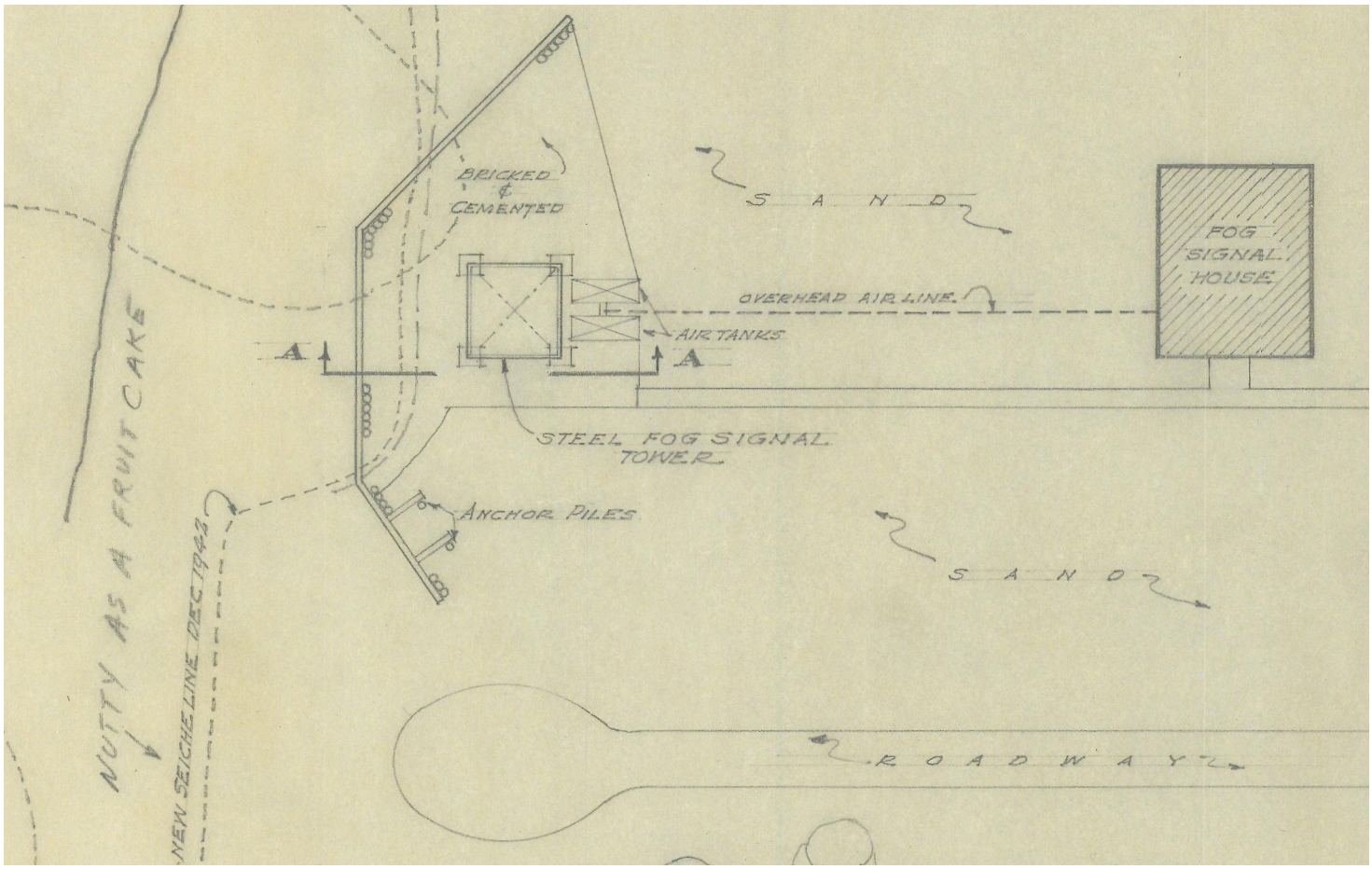

Figure 1B-55: Drawing for temporary timber shore protection to be constructed around the new fog signal tower.

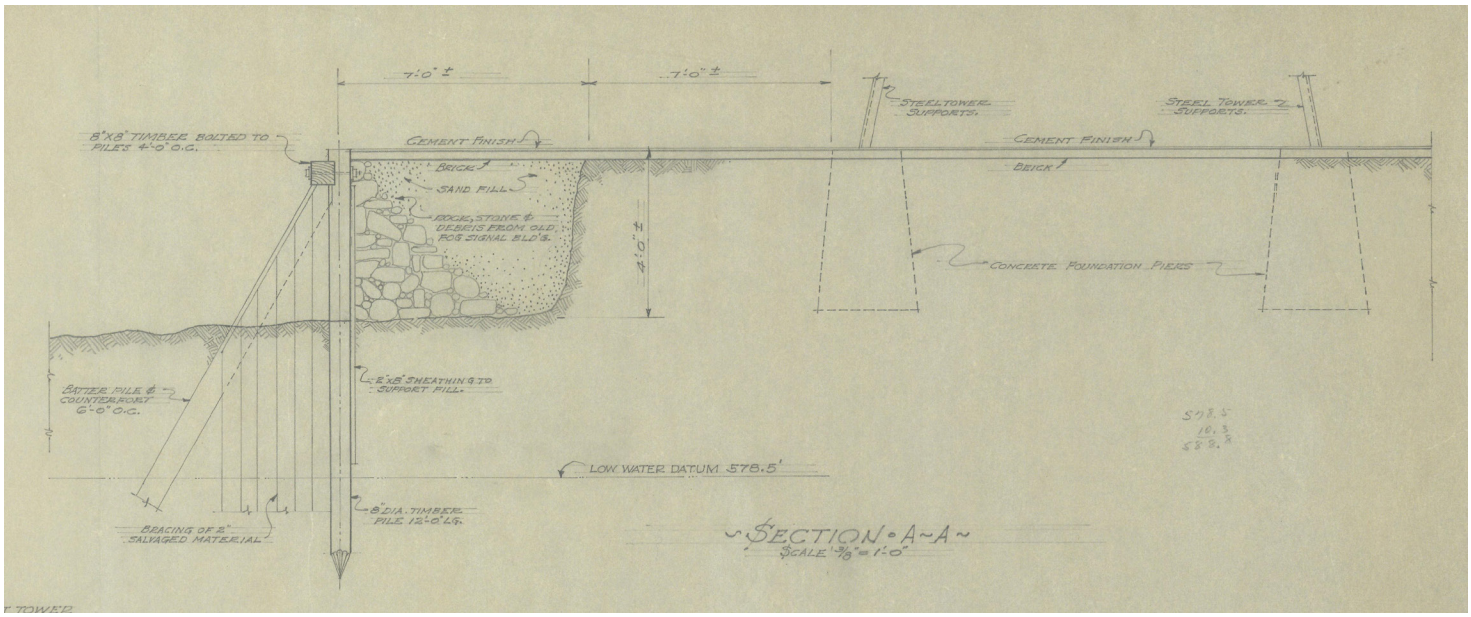

Figure 1B-56: Drawing for temporary timber shore protection to be constructed around the new fog signal tower.

Figure 1B-57: August 1943 photo looking southwest. The brick and cement cap began collapsing at the northwest corner by this time.

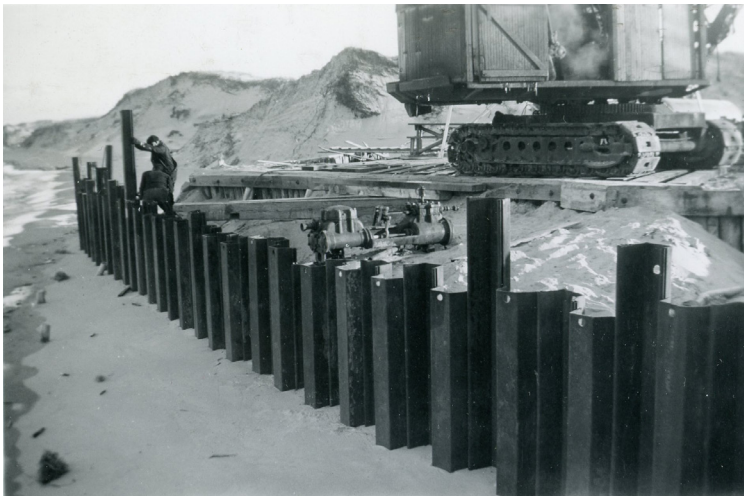

Figure 1B-58: Steel sheet piling being installed in the fall of 1943 to provide shoreline protection around the fog signal tower.

Figure 1B-59: Steel sheet piling being installed in the fall of 1943 to provide shoreline protection around the fog signal tower.

Review of historic photographs reveals that wood shingles on the keepers' dwelling porches and dormers were painted white in 1941 (Figures 1B-60 and 1B-61). The larger window openings at the west and east porches were partially infilled and small windows were installed (Figure 1B-62). The entire dwelling (brick) was then also painted white the following year (Figure 1B-63). The keepers' kitchens were also remodeled and upgraded with new ranges and refrigerators in 1942. A four-car garage was built southeast of the dwelling in 1941-1942 (Figure 1B-64). Electricity was introduced to the station in 1945 via generator. The generators

Figure 1B-60: 1941 photo looking northeast toward the tower and keeper's dwelling.

Figure 1B-61: 1941 photo looking northeast toward the tower and keepers' dwelling.

Figure 1B-62: Photo looking west at the keepers' dwelling.

Figure 1B-63: 1942 photo showing that the brick on the keepers' dwelling had been painted white.

Figure 1B-64: Photo looking northwest showing the garage that was built in 1941 - 1942 southeast of the dwelling.

were located in the fog signal control building. The lighting apparatus changed from the IOV system to electric bulbs, resulting in a substantial increase in candlepower.

Drawings were prepared for another expansion and upgrades of the keepers' dwelling in 1947 (Figures 1B-65 through 1B-69). The east porch was removed and a two-story addition was added to the east side of the dwelling. A new, enclosed porch was added at the southeast corner of the house. A wall was added in the assistant keeper's residence to create a hall

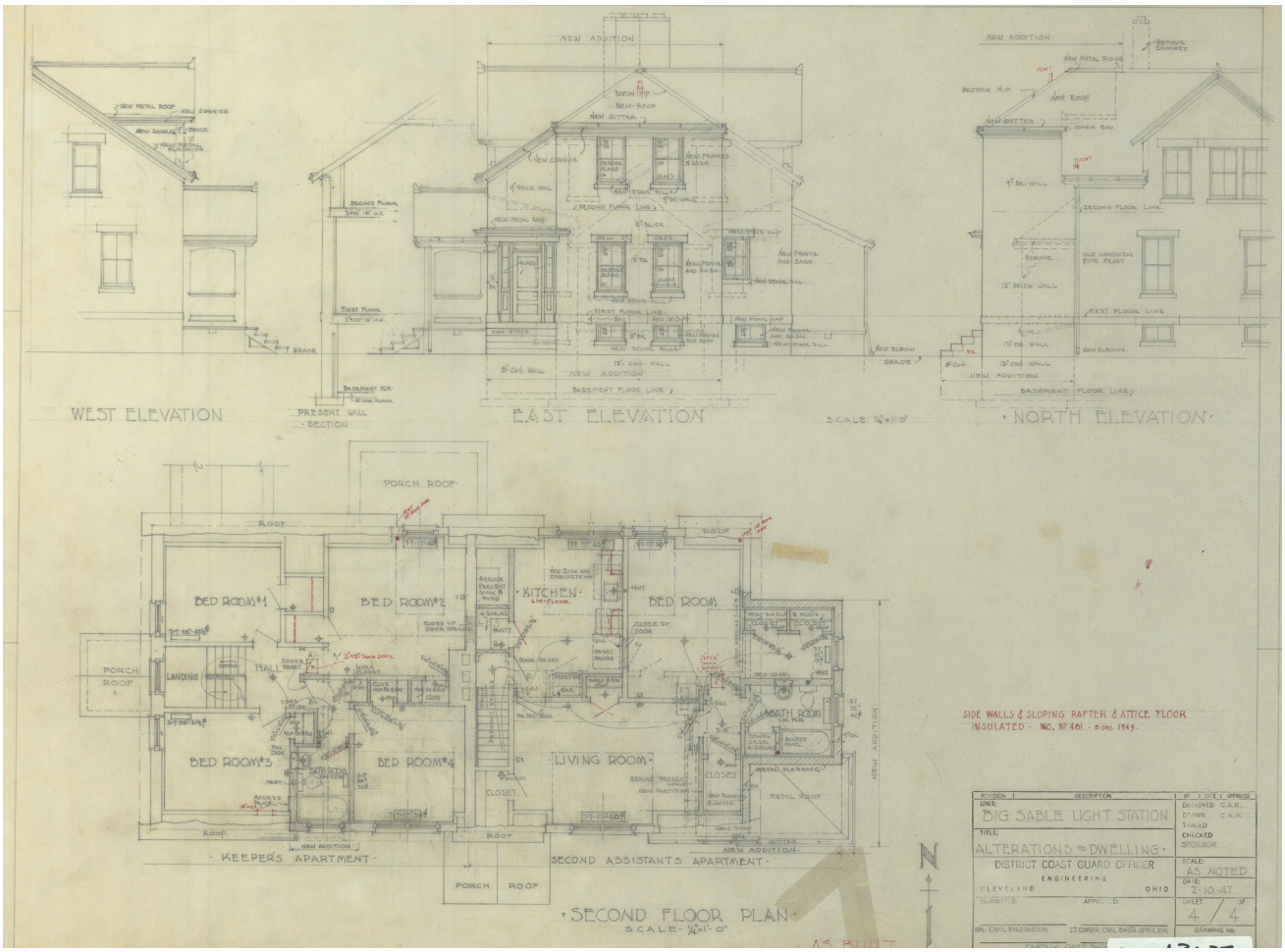

Figure 1B-65: Drawing for the 1947 expansion and upgrades of the keepers' dwelling.

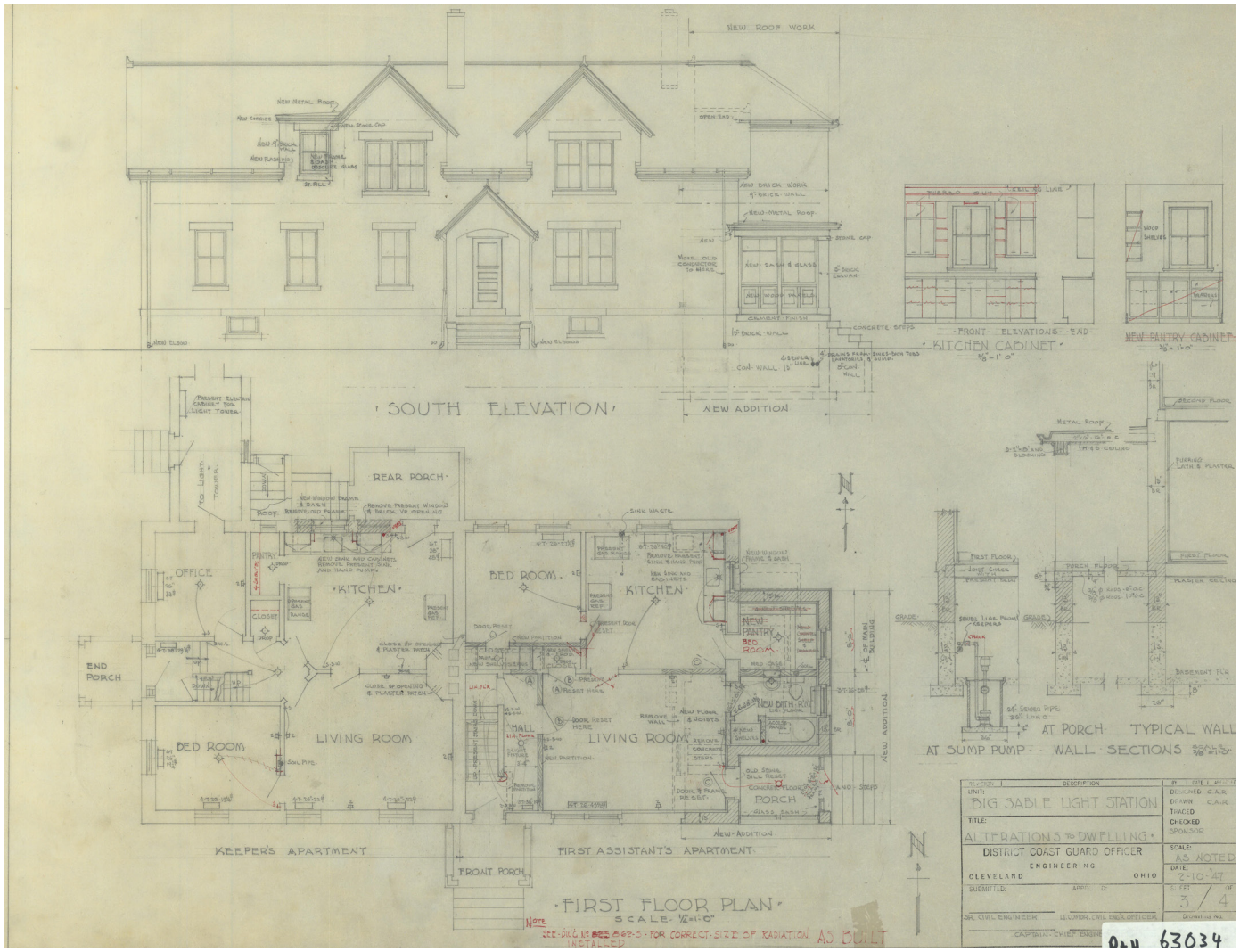

Figure 1B-66: Drawing for the 1947 expansion and upgrades of the keepers' dwelling.

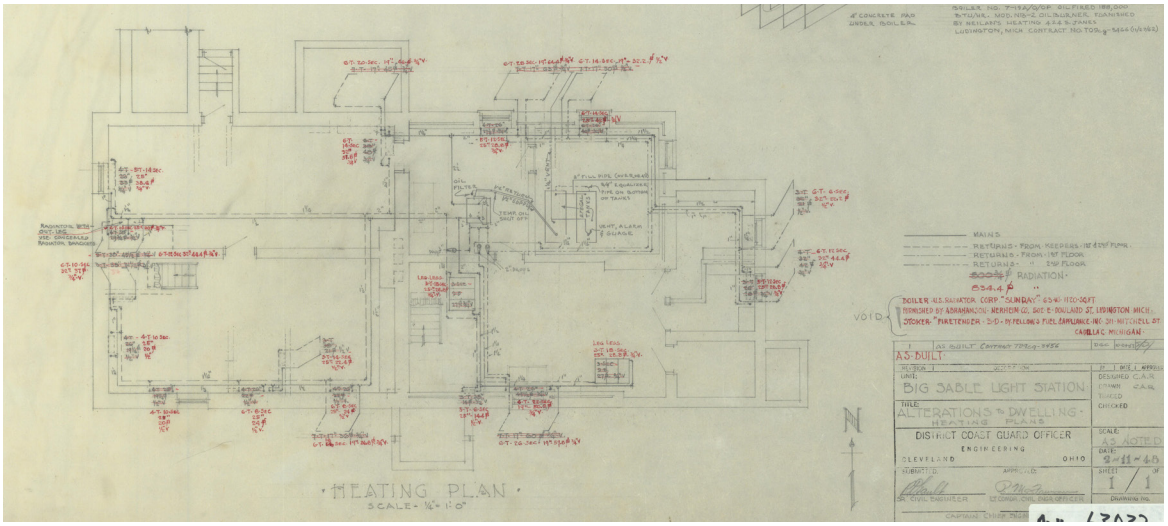

Figure 1B-67: Drawing for the 1947 expansion and upgrades of the keepers' dwelling.

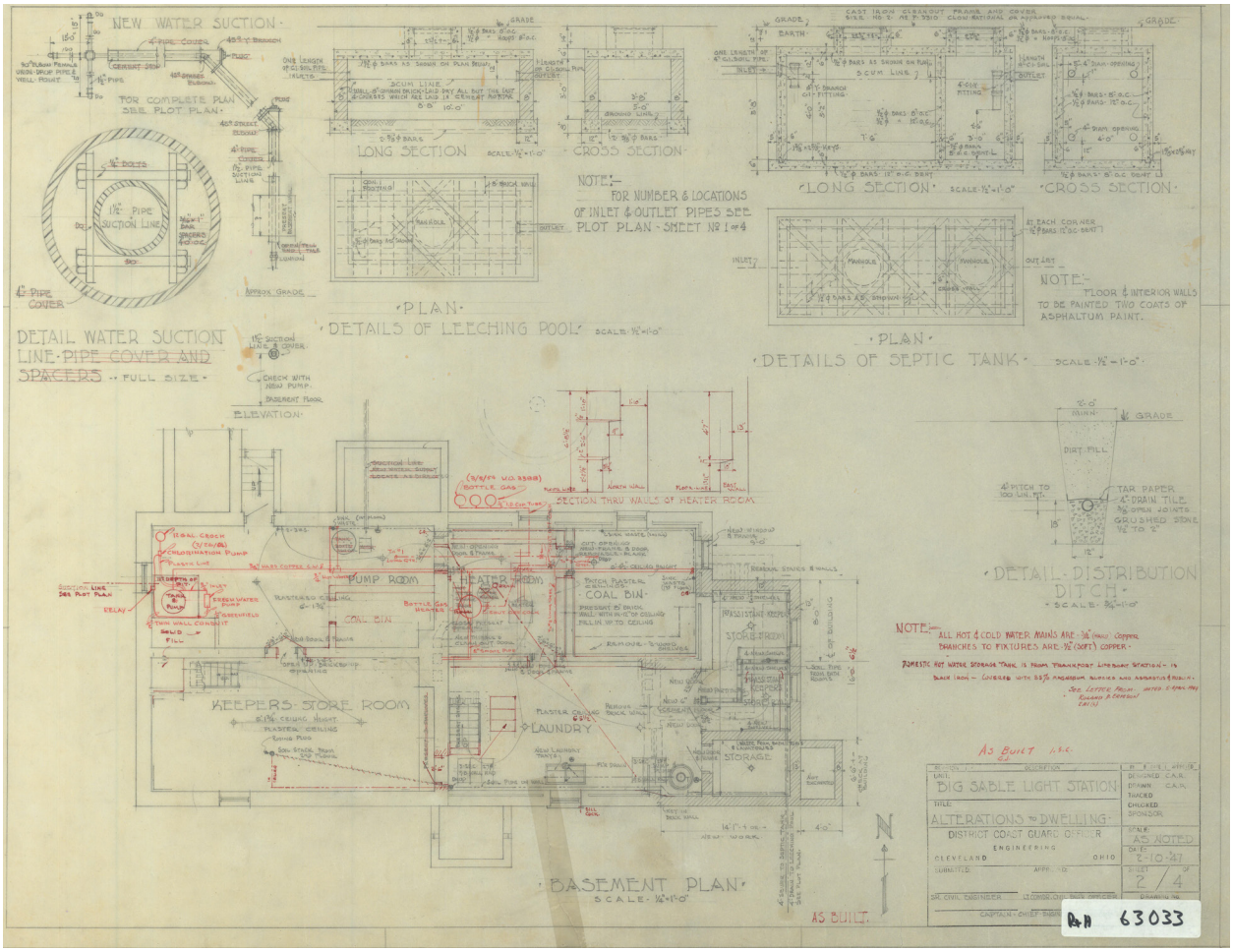

Figure 1B-68: Drawing for the 1947 expansion and upgrades of the keepers' dwelling.

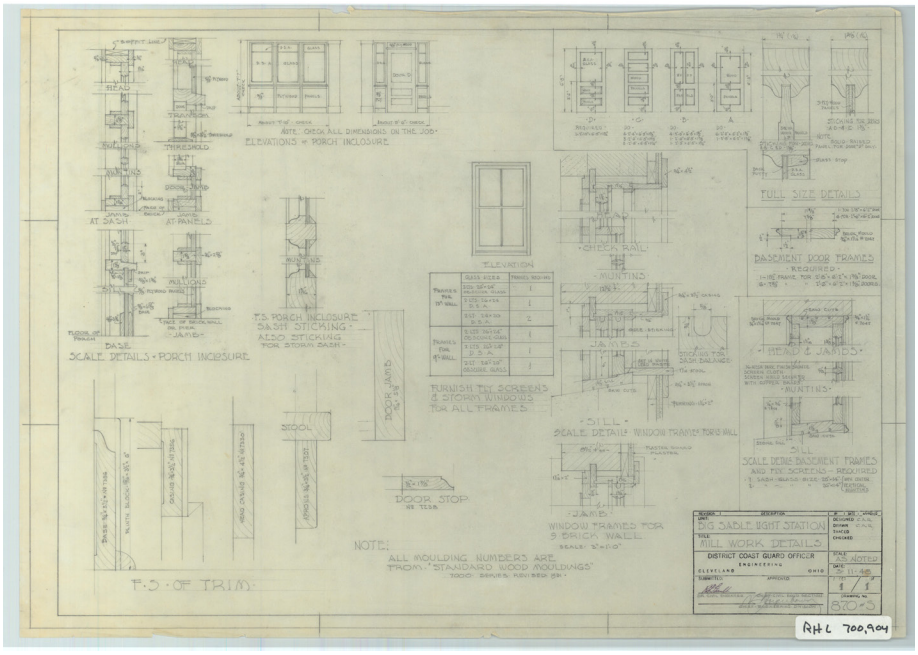

Figure 1B-69: Drawing for the 1947 expansion and upgrades of the keepers' dwelling.

Figure 1B-70: Construction photo of the keeper's dwelling addition.

Figure 1B-71: Photo after completion of the keepers' dwelling epansion and upgrades.

at the central stair, providing access to both the assistant and second assistant residences from the central, south porch. This expansion brought the dwelling to its present-day configuration. The upgrades included indoor plumbing, bathrooms and hot water heating. Two of the bathrooms were located in the new addition (one at each floor). The southwest dormer was extended west to provide more usable space for a third bathroom at the keeper's residence. New sinks and cabinets were installed in the kitchens and closets were modified. The construction began in late 1948 and work was completed in early 1949 (Figures 1B-70 and 1B-71). The dwelling was insulated in December 1949. The two wood frame privies were removed sometime thereafter (Figure 1B-73).

Commercial electric power was extended to the station in 1951-53. The garage was updated in 1955-56 (Figure 1B-72). This included a new foundation, concrete floor slab and overhead doors (the previous doors were sliding). The road to the light station was rerouted in the early 1950s due to erosion and dune encroachment caused by high water levels.

In 1966-1967, most of the remaining land reservation was ceded to the State of Michigan, reducing the station size to 15 acres (Figure 1B-74). The light was automated and the fog signal was discontinued in 1970. A stand-by light was installed on the lantern gallery in 1971 (Figure 1B-75). 1971 was the last year that "Resident Personnel" were listed on the Great Lakes Light List. With the light automated, and a standby light in operation, the buildings were vacated. Photographs from this time period indicated some of the windows were boarded up.

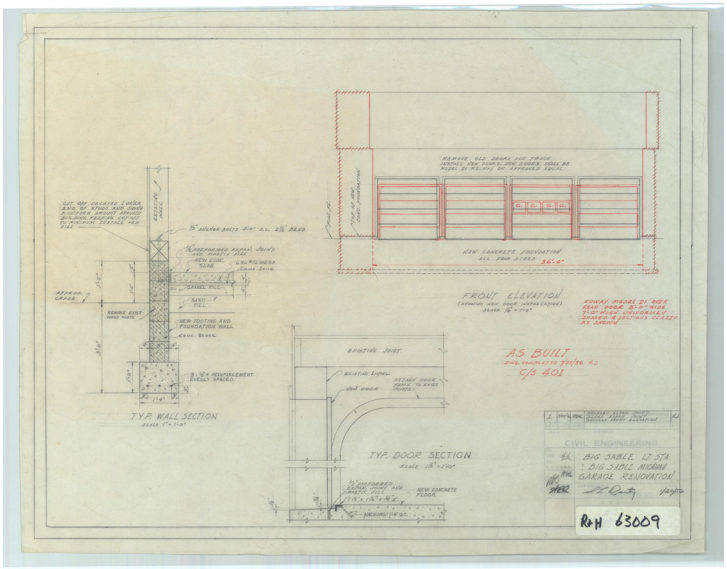

Figure 1B-72: Drawing for the garage update.

Figure 1B-73: Photos of the two privies located east of the dwelling.

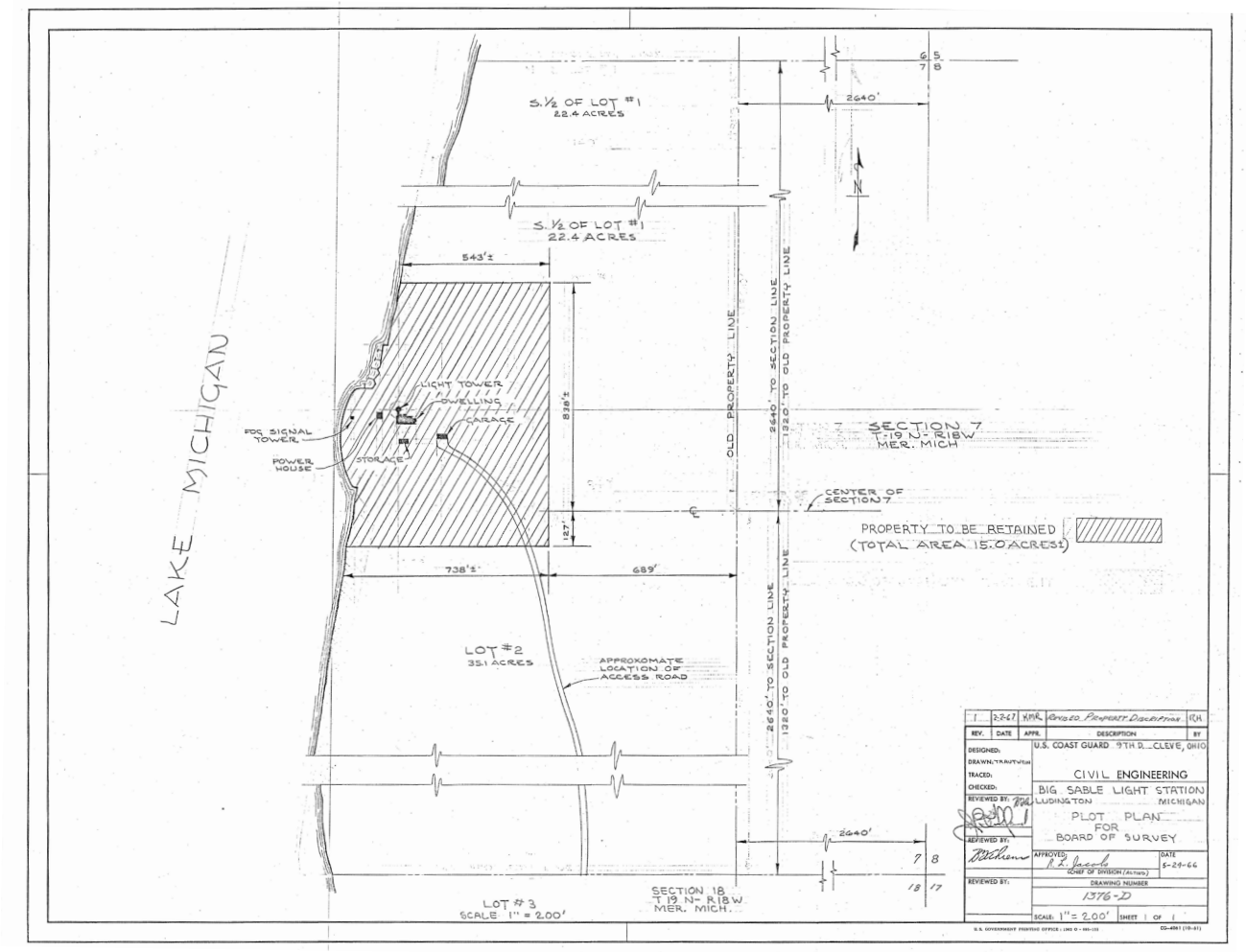

Figure 1B-74: Drawing showing the reduced land size of the station.

Figure 1B-75: Photo of the stand-by light installed on the lantern gallery in 1971

According to the Lighthouse Friends webpage about Big Sable, "After being left vacant by the Coast Guard, the light station was used by the Foundation of Behavioral Research in the early 1970s under the leadership of the research director of Kalamazoo State Hospital. After the director's position was terminated for mishandling funds, the state's Department of Social Services ran an experimental program for delinquents at the lighthouse using survival therapy techniques." With the exception of several 1974 photographs noted below, no documentation has yet been located as to the years of these uses, nor details of how they used the station buildings.

Photos in the SPLKA archives dated September 1973 note that the Keepers' Dwelling was unoccupied and the windows remained boarded up at that time. Other photos noted as taken in the summer of 1974 show a professor and students during a summer conference program (Figure 1B-76). They indicate that the Keepers' Dwelling was being used for lab demontrations; graphics and data analysis; and writing experimental procedure papers.

Other photos dated summer and fall 1974 note students and staff doing repairs at the station. This included interior and exterior painting and reglazing windows at the Keepers' Dwelling; and installation of a new trap door and straightening and replacing bent braces at the Fog Signal Tower. One photograph also notes that the Fog Signal Control Building was converted into a bunkhouse for twelve students.

Unfortunately, the station was extensively vandalized later in the 1970s. Captions included with photos included in the SPLKA archives (Figures 1B-77 through 1B-80) note that "holes had been chopped through the walls with axes to gain access to the tower" and "most of the [stair] banister was removed to be burned on the beach." Another caption noted, "Some of the boards had been removed from windows and doors, allowing both vandals and the elements inside! With so much moisture in the building, plaster ceilings and walls crumbled!"

Figure 1B-76: The typed caption with this photo in the SPLKA archives states, "Summer 1974 - Students observe as Dr. Jon DeFrance gives lab demonstration on dissection of human brain during summer conference program." Dr. DeFrance's Cirriculum Vitae listed on LinkedIn notes that he is from western Michigan, has degrees in psychology and physiology, and taught at Wayne State University from 1972 through 1976.

Figure 1B-77: Undated photo showing a section of wall that was removed.

Figure 1B-78: Undated photo showing snow accumulating in the kitchen at a broken window.

Figure 1B-79: Undated photo showing a section of wall that was removed and missing balusters on the stair.

Figure 1B-80: Undated photo showing debris at the basement stair to the exterior.

Review of historic drawings and photographs indicates that an additional sheet piling seawall with perpendicular groins had been installed extending north from the original seawall in the early 1960s (Figures 1B-81 and 1B-82). A circa 1990s SPLKA brochure says that the "seawall was breached" in 1977. Review of 1978 photos indicate that the original portion of the seawall had protected the shore along it from erosion but that the water breached the northern, 1960s extension (Figures 1B-83 and 1B-86). Several photos reveal severe erosion at the base of the tower and fog signal control building (Figures 1B-84 and 1B-85).

Review of these historic photos also indicates that the fog signal tower was gone between January and August 1978 (Figures 1B-83 and 1B-86). It is not known at this time if it was removed or collapsed into the lake similar to the former fog signal building. Erosion continued in the following years and the fog signal control building collapsed after an April 1982 storm (Figures 1B-87 and 1B-88). The concrete from the structure was used as rip rap to provide shore protection near the light tower.

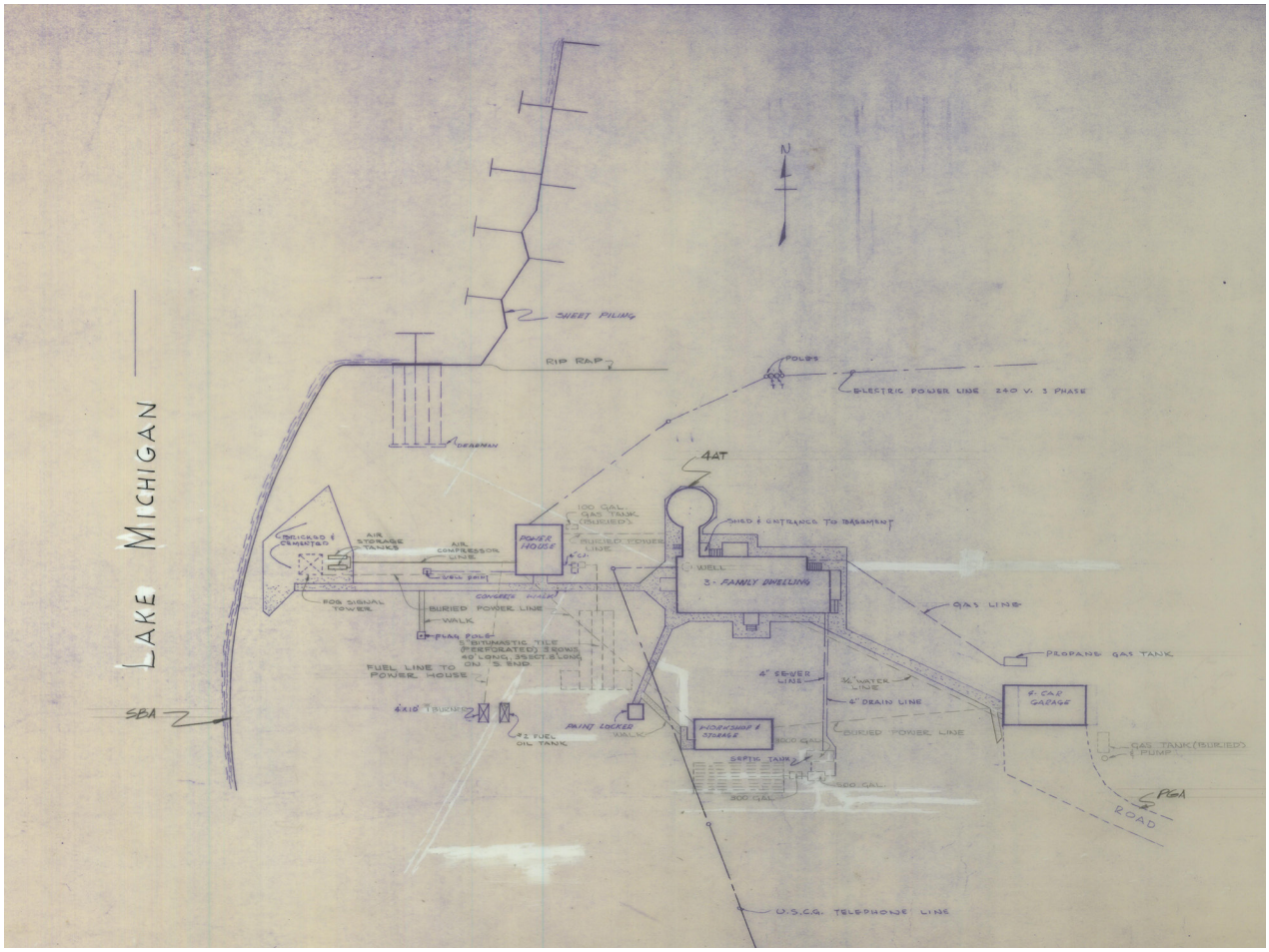

Figure 1B-81: 1963 plot plan (with updates added 1966, 1967 and 1979) showing the shore protection extension added to the north circa 1962.

Figure 1B-82: Fall 1970 aerial photograph showing the extension of the shoreline protection.

Figure 1B-83: January 1978 photo looking southwest toward the station buildings, showing the extensive erosion due to water north of the original seawall.

Figure 1B-84: 1978 photo showing shoreline erosion up to concrete sidewalk around the tower base and near the north side of the fog signal control building. The handwritten caption on the back of the photos says, "Photo taken from high ground west of compressor bldg."

According to an article in the *Ludington News*, USCG Lieutenant Ken Wilson said that the USCG hired the U.S. Army Corps of Engineers to undertake a study on shoreline protection measures later in 1982. Lieutenant Wilson told the *Ludington News* the study was, "on what it would take to preserve it [the light tower] and the minimum cost was about a million dollars to save it."

The station was surveyed as part of a Historic American Engineering Record (HAER) Great Lakes Survey conducted for the United States Coast Guard in 1979. The survey included 101 light towers, lighthouses, and light stations owned by the U.S. Coast Guard and not previously included on the National Register of Historic Places (NRHP). The results of survey lead to fifty light stations on the Great Lakes, including Big Sable, being listed on the NRHP as part of the Multiple Resource Thematic Group nomination titled "United States Coast Guard Lighthouses and Light Stations on the Great Lakes" in 1983 and 1984.

Figure 1B-85: 1978 photo showing shoreline erosion up to concrete sidewalk around the tower base. The handwritten caption on the back of the photos says, "Photo taken from west side of Lt. Tower. Erosion cutting close. Concrete walls is 7' above beach, and 8.5' above water line. Slush covers entire area.

Figure 1B-86: August 1978 photo looking southwest toward the station buildings, showing the extensive erosion north of the original seawall. The fog signal tower is no longer present.

Figure 1B-87: Summer 1982 photo looking southwest toward the station buildings. The fog signal control building has collapsed. Concrete from the structure was used as rip rap shore protection.

Figure 1B-88: 1983 aerial photo of the station showing the partially submerged shoreline protection groins, roof of the former fog signal control building on the ground, and rip rap shoreline protection north of the tower.

A 1985 *Ludington News* article indicated that the garage and workshop (converted boathouse) were torn down in 1984 and the rubble from them was dumped at the water's edge for additional erosion control (rip rap) along the shoreline. Due to concerns with stability of the tower and vandalism, the USCG removed the Fresnel lens from the lantern in 1985, and a contemporary plastic lens was installed. The USCG also erected a contemporary pole light tower southeast of the remaining station buildings, perched on a dune at a distance from the eroding shoreline (Figures 1B-89 and 1B-91). The *Ludington News* interviewed Lt. Wilson regarding this measure:

> The government cannot afford the up to one million dollar estimated cost of protecting Big Sable Light from the wave onslaught. And so far no historical societies or other groups have been interested in trying either. The reason we are building the new structure is that there is a risk that a big storm could come in and take enough of the shoreline to demolish the existing structure. The new structure is being built and installed for about $50,000, a fraction of the cost of trying to control the erosion threatening the existing light. Instead of being inside the top of the lighthouse, the new light will be afixed to a bracket outside the top of the steel tube, which will look more like a pole than a lighthouse. The light will be visible eight to 10 miles.

Lt. Wilson informed the *News* that erection of the light structure was scheduled to be completed by December 15th and that the Big Sable Light could be decommissioned and the new light lit by the Coast Guard about that time. Though Wilson wasn't certain whether the switch in lights would be made immediately upon completion of the new light. Based on review of historic documents and photos, the new pole light was never put into service and was later removed in 1996.

Figure 1B-89: 1989 photo looking northwest showing the new pole tower and the original light tower.

Figure 1B-90: 1989 aerial photo of the station showing the eroded shoreline between the steel sheet piling seawall at the west and the rip rap at the north.

Figure 1B-91: Circa 1992 aerial photo of the station showing the new pole light tower and the additional steel piling and rip rap shoreline protection installed by SPLKA in 1989.

The article also quoted Lt. Wilson relative to the USCG's efforts to try to get another entity to preserve and maintain the existing light tower and keepers' dwelling:

> We can't economically justify saving it, Wilson said. "We tried giving it to people and the ones we've offered it to - for the same reason as we couldn't afford to save it - couldn't afford to do what is necessary to protect it. The Coast Guard plans no further maintenance of the existing light but has decided not to tear it down or the attached house which once housed up to three keepers and their families. The house has been abandoned since the light was automated about 10 years ago. Both it and the light have been severely vandalized in recent years.
>
> Demolition of the existing light has never been in our plans," Wilson said. "In fact, if we could have found a good, cheap way of saving the shoreline we would have kept it because it is bigger and a good landmark." Wilson said. "We tried. It was a nice structure, scenic, classic. If anyone would be interested in trying to do something out of their own pocket we are certainly try pursue it [sic] we are certainly amendable to talking to them about it," Wilson said. "We can't justify spending taxpayers dollars on that sort of thing so we're just leaving it until nature takes it course." We have offered the light to a number of different societies, none of whom wanted it," Wilson said. "I think right now where it sits is that we've offered it to the National Park Service and the ball is in their court now."

Figure 1B-90 shows that while the rip rap installed in the 1980s kept the shoreline away from the base of the tower, the shoreline was still eroded behind the steel seawall.

Some unsourced references indicate that the station was again leased to the Foundation of Behavioral Research in 1986. They state that the organization went into this lease with the intention of saving and preserving the station. Then, in 1987, the Big Sable Point Lighthouse Keepers Association (BSPLKA) was formed. According to a circa 1990s BSPLKA brochure, the organization "was formed in 1987 by a small group of Local Ludington residents, led by Mr. Dick Smith, dedicated to restoring and preserving Big Sable Point Lighthouse, located in the beautiful Ludington State Park."

According to the Great Lakes Lighthouses Encyclopedia, the two organizations worked together:

> The Foundation of Behavioral Research became caretakers of the lighthouse again in October 1986, when they signed a twenty-five year lease on the property. The foundation worked closely with Big Sable Point Lighthouse Keepers Association, which was formed in 1987 to save the station. Local businesses joined in the battle to fight erosion on the point, and the work paid off – the backup light on the pole tower never had to be used.

The Encyclopedia also noted that by 1987, the Fresnel lens had been restored and was on display at the Rose Hawley Museum in Ludington.

BSPLKA was awarded the lease on the station in 1987. It is not currently understood if the Foundation of Behavioral Research was involved after that time. The station was listed on the State Register of Historic Places in 1988. Local community member Wendall Putz also donated two "antique" yard light pole fixtures to SPLKA that year. They were installed southeast and southwest of the Keepers' Dwelling (Figure 1B-92).

Figure 1B-92: 1988 photo of one of the donated "antique" light poles installed at the station.

Figure 1B-93: 1989 photo taken during the 1989 tower repairs showing a section of the metal cladding that was removed for replacement.

Figure 1B-94: 1989 photo taken during the 1989 tower repairs showing a section of the metal cladding being welded.

Figure 1B-95: 1989 photo of SPLKA members, State Historic Preservation Representative Brian Conway, and other stakeholders showing commemorative grant checks in front of the new steel piling shoreline protection..

BSPLKA led several restoration efforts in the late 1980s and 1990s. This included substantial shoreline erosion mitigation and prevention measures in 1989 (Figure 1B-91), as well as extensive repairs and repainting of the light tower metal cladding in 1989 and 1994 (Figures 1B-93 and 1B-94). Review of photographs indicates that the 1989 work was funded in part by grant funding from the Congressional $3M Lighthouse Bicentennial Fund. This matching grant-in-aid was administered by the National Park Service and Michigan Department of State (Figure 1B-95).

Additional restoration work in the 1990s included masonry repointing and replacement of the front porch floor (Figures 1B-96 and 1B-97). BSPLKA incorporated as a Non-Profit 501 (c) (3) in 1991. During the 1990s, restoration of the station continued in earnest. The keepers' dwelling roof was replaced in 1997. Other BSPLKA restoration and upgrade work included restored floors (Figures 1B-98 and 1B-99, asbestos removal, painting, heating, electrical and plumbing systems.

Figure 1B-96: Circa 1990s photo of SPLKA volunteers repointing the masonry wall of the Keepers'Dwelling.

Figure 1B-97: Circa 1990s photo of SPLKA volunteers replacing the south porch flooring.

Figure 1B-98: 1991 photo of SPLKA volunteer removing floor tiles for restoration of the wood flooring.

Figure 1B-99: 1991 photo of restored wood flooring.

Figure 1B-100: 1996 photo of the pole tower being removed.

The pole tower south of the Keepers' Dwelling was removed via helicopter in the summer of 1996 (Figure 1B-100). BSPKLA held a 130-year anniversary of the light station on the evening of November 1, 1997 (Figures 1B-101 and 1B-102). The access road leading up to the station was lit with luminaires; candles were lit in the Keepers' Dwelling windows; and lights were strung on the lantern gallery. Presentations and musical performances were given from the front porch.

Figure 1B-101: Photo taken during the November 1997 130th anniversary celebration. SPLKA Executive Director Mary James is at the microphone.

Figure 1B-102: Photo taken during the November 1997 130th anniversary celebration.

Around 1998, the organization started a volunteer program for light maintenance and interpretation of the station. According to the Great Lakes Lighthouses Encyclopedia:

> A unique idea that the Keepers Association has developed to raise money for restoration is their volunteer resident-keepers program. Families, couples or individuals apply for a two-week stay at the lighthouse. If accepted, the person becomes the light's keeper (caretaker), enabling the station to be open to the public seven days a week. It's a win/win situation. The station gets free help and the people get free lodging and a terrific vacation. Overwhelming response to this program has resulted in a waiting list.

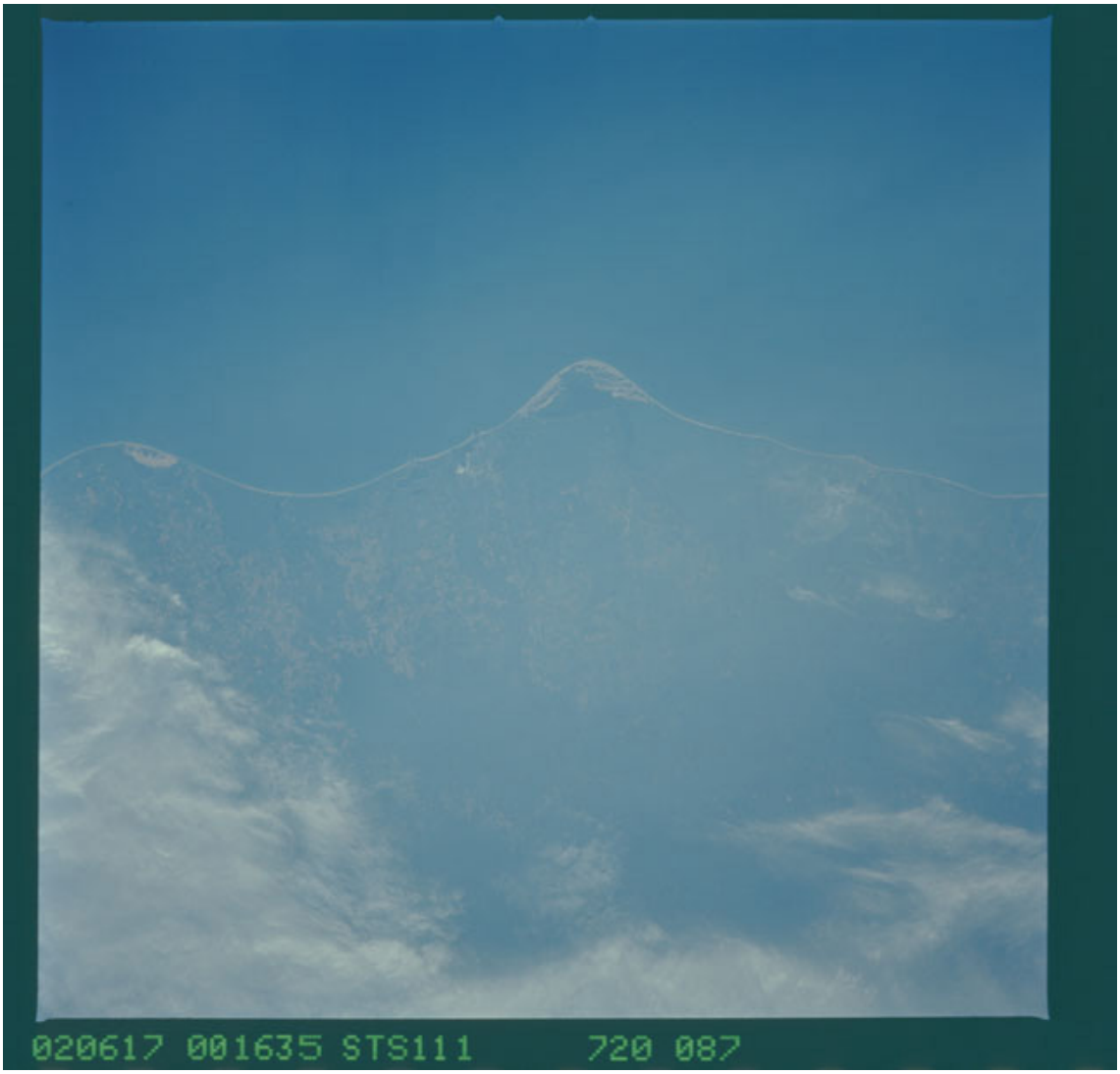

Figure 1B-103: 2002 photo of Big Sable Point in the SPLKA archives noted as being taken from the space shuttle.

This program has been on-going since. A state historical marker was installed at the station in 2000 and the station was transferred from the USCG to state ownership in 2002. An interesting piece of history discovered during research for this HSR was a photograph of the station taken in 2002 from the Space Shuttle (Figure 1B-103). That same year, BSPLKA acquired the lease for the nearby Little Sable Lighthouse.

By 2006, the restored Fresnel lens changed locations and was on display at the Historic White Pine Village just south of Ludington. BSPLKA also acquired the lease for the Ludington North Breakwater Light in 2006. The organization's intentions for Big Sable Light Station was to return it to its appearance in 1948. Toward that effort, they had a replica of the 1941 fog signal tower constructed according to the original construction drawings (Figure 1B-104). BSPLKA acquired the concession agreement for the White River Light Station in 2012 and officially changed its name to Sable Points Lighthouse Keepers Association (SPLKA). According to their website, "Our non-profit organization is made up of approximately 760 members hailing from across the country."

The steel sheet piling seawall was extended approximately 150 feet to the south in the winter of 2012-2013. Rip rap was installed on the lake side of the new seawall and additional rip rap was added in areas along the existing seawall (Figure 1B-105). .

Figure 1B-104: Photo taken during construction of the replica the fog signal tower.

Figure 1B-104: Photo taken during construction of the south seawall extension in the winter of 2012 - 2013.

Figure 1B-106: Photo taken during the 2013 masonry workshop.

Masonry contractor Blair Bates lead a masonry workshop at the station in 2013, which included rebuilding the outer wythe of brick at the south wall of the Keepers' Dwelling (Figure 1B-106). The Fresnel lens underwent another significant restoration in 2016 and was placed on display at the Port of Ludington Maritime Museum, where it remains today. SPLKA has continued restoration efforts at the station, including replacement of the Keepers' Dwelling roof in 2017.

SPLKA was awarded a 2018 Governor's Award for Historic Preservation for its stewardship efforts at the four historic lighthouses under its care. High water levels and wave action in 2019 resulted in significant water ponding between the seawall and the Light Tower and Keepers' Dwelling. Water also entered the Keepers' Dwelling basement through cracks in the concrete floor slab. A sump pump was subsequently installed.

Most recently, SPLKA has committed matching funds to the Michigan Lighthouse Assistance Program grant they received to develop this Historic Structure Report.

PART 1B ENDNOTES

1. Lighthousefriends.com: Big Sable Point, MI [https://www.lighthousefriends.com/light.asp?ID=196]

2. The spelling of the location and subsequent light station varies in historic documents, including "Grande Pointe au Sable", "Grand Point au Sable", and Grande Point aux Sables."

3. "FORM 152" stamped: "From "Statement of Appropriations, &c." from March 4, 1789, to June 30, 1882. Published in 1886."

4. Wright, Larry and Wright, Patricia, Great Lakes Lighthouses Encyclopedia, Erin, Ontario, Canada: Boston Mills Press, 2006.

5. Annual Report Clippings

6 "Seeing The Light – The story of Cream City brick." http://www.terrypepper.com/lights/closeups/cream_city_brick/cream_city_brick.htm, updated 12/02/2007.

7. Annual Report Clippings

8. Annual Report Clippings

9. Annual Report Clippings

10. This is the only reference to the light station in historical materials reviewed for this report that the station is referred to as "Big Sable" rather than "Grande Pointe au Sable" before the name was officially changed in 1910.

11. "E. H. Lentze, Commander, U.S. Navy, Inspr. 9th L.H. Dist., Light-House Establishment, Office of the Light-House Inspector, Ninth District, Chicago, Ill., to the Light-House Board, Washington, D.C. Subject: Change in color of stations, October 25th, 1897."

12. Index of Correspondence bound in letter books 1897-1898 letters; SPLKA researcher's notes.

13. "Lieut. Col. Of Engineers, U.S.A., Light-House Engineer, 9th District, Light-House Establishment, Office of Engineer, Ninth and Eleventh Districts, Detroit, Mich. to The Light-House Board, Washington, D.C., Subject: Grand Pointe au Sable, Mich., Sept. 15, 1898."

14. Annual Report Clippings

15. "Acting Commissioner to Lighthouse Inspector, Chicago, Ill. Re: Big Sable, Mich. And Cana Island, Wis., April 26, 1912.

16. Major, Corps of Engineers, U.S.A., Engineer Secretary. Treasury Department. Light-House Establishment, Office of the Light-House Board, Washington, D.C. to the Secretary of the Treasury. Nov. 29, 1899.

17. Captain, Corps of Engineers, Engineer, Ninth Light-House District. Light-House Establishment, Office of Light-House Engineer, Ninth District, Milwaukee, Wis., to The Light-House Board, Washington, D.C., Subject: Grand Pointe au Sable, Mich. March 15, 1900.

18. Annual Report Clippings

19. [unsigned] Office of Inspector, 12th District, Department of Commerce and Labor, Lighthouse Service to The Commissioner of Lighthouses, Washington, D.C. Re: Big Sable, Mich. And Cana Island, Wis., April 30, 1912.

20. Annual Report Clippings

21. Lt. Col., Corps of Engineers, U.S.A., Engineer Secretary to The Engineer, Ninth Light-House District, Milwaukee, Wis. Re: OIL ENGINES, Grande Pointe au Sable, Mich., Lt-Stn., October 14, 1908

22. Inspector, 12th district, Chicago, Department of Commerce and Labor, Lighthouse Service to The Commissioner of Lighthouses, Washington, D.C. re: Big Sable Light-Station, Mich., August 23, 1911.

23. Ninth District, Department of Commerce and Labor, LIGHT-HOUSE ESTABLISHMENT, DESCRIPTION OF BUILDINGS, PREMISES, EQUIPMENT, ETC., AT Grand Pointe au Sable, Mich. LIGHT-STATION, 9th Light-House District, Milwaukee, Wis. June 8th, 1909

24. Ninth District, Department of Commerce and Labor, LIGHT-HOUSE ESTABLISHMENT, DESCRIPTION OF BUILDINGS, PREMISES, EQUIPMENT, ETC., AT Grand Pointe au Sable, Mich. LIGHT-STATION, 9th Light-House District, Milwaukee, Wis. June 8th, 1909

25. Captain, U.S.N., Naval Secretary to The Honorable, The Secretary of Commerce and Labor. Subject: Grand Pointe au Sable. Change in name. April 30, 1910

26. Form 80, Recommendations for Repairing Aids to Navigation, Department of Commerce and Labor, Lighthouse Service, Office of Lighthouse Inspector, Twelfth District, Milwaukee, Wis., Sept. 23, 1913.

27. Form 80, Recommendations as to Aids to Navigation, Department of Commerce, Lighthouse Service, Office of Lighthouse Inspector, 12th District, Milwaukee, Wis., September 6, 1916

28. Form 80, Recommendations for as to Aids to Navigation, Department of Commerce and Labor, Lighthouse Service, Office of Lighthouse Inspector, 12th District, Milwaukee, Wis., Nov 10, 1919

29. "BIG SABLE LIGHTHOUSE RESERVATION DEED" and 1926-8-9 NOTARY RE DEED.pdf

30. Form 80, Recommendations for as to Aids to Navigation, Department of Commerce, Lighthouse Service, Office of Superintendent of Lighthouses, 12th District, Milwaukee, Wis., January 18, 1934." Stamped authorized Feb 1, 1934.

Sable Points Lighthouse Keepers
Association

1C Chronology of Development + Use

This section provides a summary of the construction, modifications and use of the station. This section was developed through analysis and coordination of the historical information obtained with the physical evidence observed during on-site physical investigation.

CHRONOLOGICAL TIMELINE

As previously presented in detail, the navigational aids at Big Sable Point Light Station have continually evolved during their lifetime. As was typical for all light stations, physical change was often directly correlated with necessity, in terms of continuous efforts to improve the operation and efficiency of the aids to navigation to mariners, as well as improving other aspects of the station. In the case of Big Sable Point Light Station, change was also necessitated by the eroding shoreline, another common issue at exposed shore stations. As a result, several structures were built, and modified over time, at the station.

The following provides a summary of the development and alterations at Big Sable Point Light Station.

Episode 1: 1856 – 1899

Significant features and/or events: First lighthouse appropriation (not built), second appropriation, lighthouse and keeper's dwelling built, lighthouse reservation surveyed, circular oil house erected

Original Name: Grande Pointe au Sable Light Station

1856: Congress appropriates $6,000 in funds for building a lighthouse

Land reserved for lighthouse reservation per Presidential Executive Order

1857: Fourth Order Fresnel lens fabricated by Henry Lepaute, Paris France (shipped to US, but not used at Big Sable)

1858: Additional land reserved for lighthouse reservation per Presidential Executive Order

1859: Minimal funds spent, did not proceed with lighthouse, money returned to surplus fund

1865: Need for light made known again

1866: Congress appropriates $35,000 in funds for building a lighthouse

Additional land reserved for lighthouse reservation per Presidential Executive Order

1867: Light tower and attached dwelling built, first lit on November 1st

1876: *United States Life-Saving Station* established nearby

1881: Need for fog signal acknowledged by mariners

1883: Lighthouse reservation surveyed

1892: Round metal oil house erected

New well driven

Unclear if a boathouse was built (had been approved for keeper to built one)

Late 1890s:

Need to paint light tower to be a better daymark

Tower brick significantly deteriorating

Episode 2: 1900 – 1907

Significant features and/or events: Light tower encased in steel plates, small brick oil house built

1900: Light tower encased in steel plates to watchroom level; painted white with black central stripe

1903: Small brick oil house constructed

1905: Steel plates extended up to underside of lantern deck

Episode 3: 1908 - 1939

Significant features and/or events: Fog Signal Building constructed; Keeper's Dwelling expanded; Assistant Keepers assigned to station; name of station changed; fog signal changed from siren to diaphone

1908: Drawings for expansion of Keeper's Dwelling prepared

1909: Fog Signal Building constructed; compressed air siren operational May 20th

Keeper's Dwelling expanded to accommodate assistant keeper

Second Assistant Keeper assigned to station

Comprehensive inspection and description of station prepared by USLHE

1910: Station name change from Grande Pointe au Sable to Big Sable

IOV lamp installed in lantern

Large brick oil house constructed near Fog Signal Building

1913 - 1914

New barn constructed

1916 - 1917

Tower lantern painted black

1920: Wood plank walks replaced with concrete walks

Keepers' Dwelling basement modified for coal storage for keepers' stoves

Cess pool removed and improved sewage system installed

One of old privies and shed removed

1921 USCG station inactive

1924: Telephone service to station

1925: New large flagpole installed

Mid 1920s:

Round oil house removed

1926: Majority of station reservation deeded to State of Michigan for state park

1929: Boathouse moved short distance south

1930: Government real estate survey of station

1933: Road built to the station

1934: Fog signal changed from siren to diaphone; dormer constructed on Fog Signal Building to accommodate the diaphone

1938: Boathouse foundation rebuilt

1939: Keepers' Dwelling roof replaced and new gutters installed on all buildings

Episode 4: 1940 - 1948

Significant features and/or events: Keepers' dwelling painted; fog signal building and large oil house collapsed due to erosion; new fog signal tower and control building built; garage built; shore protection installed; electricity provided

1940: Very bad storm on Lake Michigan in November, mariner casualties, extensive shoreline erosion

Martin birdhouse built

1941: Fog signal engine and air receiver replaced

Wood shingles on dwelling porches and dormers painted white

Continued shoreline erosion

Large Oil House collapsed due to erosion

Boathouse moved east (south of dwelling) to accommodate construction of new fog signal tower; boathouse use converted to workshop/garage

New fog signal tower constructed

1942: Fog signal control building constructed

Fog Signal Building collapsed into lake during storm due to shoreline erosion

Keepers' Dwelling, Passageway, and small oil house painted white

Garage built

1943: Timber shore protection and concrete slab installed at fog signal tower

Steel sheet piling shore protection installed along shoreline

1945 – 1946:

Electricity provided to station via on-site generators

Light converted from IOV to electricity

1948: Extension of Keepers' Dwelling begun

Episode 5: 1949 – 1971

Significant features and/or events: Keepers' Dwelling expanded and upgraded with heat and electricity; light automated, fog signal discontinued and USCG no longer in residence

**This is the period of time that includes the presence of all of the structures at the light station, with the exception of the 1909 Fog Signal Building and early barns. The configuration of the Keepers' Dwelling from this period remains today.

1949: Extension and upgrades to Keepers' Dwelling completed

1953: Commercial electricity provided to station via overhead power lines

Significant storm required emergency shore protection

1955 – 1956:

Garage updated – new foundation and slab, overhead doors installed

1966: Most of remaining lighthouse reservation land given to state (15 acres retained)

1968: Light automated

1970: Fog Signal discontinued

1971: USCG personnel left; buildings boarded up

Stand-by light installed on lantern gallery

Episode 6: 1972 - 1986

Significant features and/or events: Significant vandalism; station leased to foundation; degradation; outbuildings gone

Early 1970s:

Used by the Foundation of Behavioral Research for youth program

1970s: Significant vandalism

1977: Shore protection breached and shoreline less than five feet from tower

1978: Significant erosion

Fog Signal Tower lost, presumably due to erosion

1982: Fog Signal Control Building collapsed

Army Corps of Engineers shoreline preservation study

1983: Listed on the National Register of Historic Places as part of Great Lakes Light Stations

1984: Workshop (converted boathouse) and garage torn down

1985: Fresnel lens removed and contemporary lens installed

New pole light installed (never put into operation)

1986: Station leased to Foundation of Behavioral Research

Episode 7: 1987 - present

Significant features and/or events: Non-profit formed and undertakes restoration of station and develops on-going volunteer program

1987: Big Sable Point Lighthouse Keepers Association formed (BSPLKA)

Station leased to BSPLKA, undertakes repairs through today

Fresnel lens restored and displayed in museum

1988: Listed on State Register of Historic Places

1989: Significant shoreline protection installed

1994: Tower steel cladding repaired and painted

1996: Pole tower removed

1997: Keepers' Dwelling roof replaced

1990s – Present

Keepers' Dwelling restored to 1948 appearance

Volunteer Keepers Program

2000: Historical marker installed

2002: Station ownership transferred to State of Michigan

2004 – 2012:

BSPLKA acquires lease for three other lighthouses in vicinity

2012 - 2103:

Shoreline protection extended 150 feet to the south

2009: Replica Fog Signal Tower constructed

2012: BSPLKA changes name to Sable Points Lighthouse Keepers Association (SPLKA)

2017: Keepers' Dwelling roof replaced

2018: SPLKA receives Governors Award for Historic Preservation

2023: Historic Structure Report commissioned

CHRONOLOGY & ANALYSIS OF ALTERATIONS

This section provides a summary of the modifications of the existing structures at the station. This section was developed through analysis and coordination of the historical information obtained with the physical evidence observed during on-site physical investigation and materials analysis.

KEEPERS' DWELLING

Additions

The Keepers' Dwelling was first expanded in 1909, and again in 1948-1949. Both additions were at the east side of the building. Dormers were added during the 1909 expansion and the southwest dormer was expanded in 1948-49 (Figures 1C-01 and 1C-02).

Figure 1C-01: Circa 1910 photo taken shortly after the first expansion of the Keepers' Dwelling.

Figure 1C-02: 1949 photo taken during the second expansion of the Keepers' Dwelling.

Exterior

Roof

Written documentation indicates that the roof was replaced in 1908, 1939, 1949, 1997, and 2017. Review of historic photographs indicates that the original roof was wood shingles. The original roofing was replaced and the addition was roofed with wood shingles in 1909. The stone chimney cap was also replaced and a second chimney was added at the addition. It appears that the 1939 replacement roofing were dark asphalt shingles and the ridge boards and yankee gutters were painted white (Figure 1C-03).

The asphalt shingles were replaced and the 1909 chimney was removed in 1949. Based on later, color photos from the 1970s, it is assumed that the replacement roofing was red ashpalt shingles (Figure 1C-04). However, a few undated photos assumed to be from the late 1970s show a black asphalt shingle roof (Figure 1C-05). This may be due to the Foundation of Behavioral Research replacing the roof while leasing the station in the 1970s. Review of Figure 1C-03 also shows that the yankee gutters had been removed and hung gutters were in place.

The 1996 and 2017 roofing replacements utilized red asphalt shingles. Wood snow guards were also installed to replicate the historic Yankee gutter system. Wood ridge boards were also installed to match the historic metal ridge boards. These are painted white.

Figure 1C-03: Circa 1940s photo of the Keepers' Dwelling.

Figure 1C-04: Circa 1940s photo of the Keepers' Dwelling.

Figure 1C-05: Circa late 1970s photo of the Keepers' Dwelling.

Figure 1C-06: Circa 1940 photo of the keepers' and their wives at the south porch, before the Keepers' Dwelling was painted..

Figure 1C-07: Circa 1950s photo of a woman and dog at the west porch, after the Keepers' Dwelling was painted..

Figure 1C-08: Circa 1990s photo of SPLKA members at the west porch, after the Keepers' Dwelling windows were painted white..

Exterior Paint

The wood shingle cladding at the dormers and porches was first painted in 1941. The exterior brick was first painted in 1942. See Figures 1C-03 and 1C-04. Review of historic photos reveals that the west portion of the north elevation (west of the passageway and between the passageway and the enclosed, north porch) were not painted until several years later.

Windows

Review of historic drawings indicate that the window sash were replaced at the original portion of the Keepers' Dwelling in 1908. The drawings do not indicate that they were replaced during the 1948-1949 project; only new windows were added. Based on review of historic photos, it appears that the window sash were painted a dark color through the 1960s. It is not known when they were first painted white, but sometime by the mid to late 1990s (Figure 1C-08).

Based on physical review, it appears that a few of the existing windows may be original, but the majority are replacement windows. It is not currently known when they were installed.

Interior

There has been minimal modifications to the interior since the 1948-1949 expansion and renovation; mainly limited to finishes and furnishings and replacement of light fixtures. Comparison of photographs show that the existing kitchen cabinetry dates to the 1948-1949 renovation (Figures 1C-09 through 1C-14). The upper cabinet doors have been removed in the west, first floor kitchen. The kitchen sink was removed in the 1990s but has been reinstalled (Figures 1C-13 and 1C-14).

Figure 1C-09: Circa 1960s photo of Keeper Vavrina and others in the first floor, west kitchen..

Figure 1C-10: Circa 1960s photo of Assistant Keeper Meverdens wife and grandchild in the first floor, west kitchen..

Figure 1C-11: 2023 photo of the first floor, west kitchen..

Figure 1C-12: 2023 photo of the second floor kitchen..

Figure 1C-13: 1992 photo of the first floor, east kitchen..

Figure 1C-14: 2023 photo of the first floor, east kitchen..

Figure 1C-15: 1974 photo of the students doing a project for the Foundation for Behavioral Research in one of the bedrooms..

Figure 1C-16: 1963 photo of the Assistant Keeper's (east, first floor)living room..

Figure 1C-17: 1992 photo of the Assistant Keeper's (east, first floor)living room..

Figure 1C-18: 2023 photo of the Assistant Keeper's (east, first floor)living room..

Review of photos taken when the Foundation for Behavioral Research leased the station show and note that carpet was installed in some of the rooms (Figures 1C-15). Review of 1990s photos show that linoleum-type floor tiles were installed in some rooms. SPLKA removed these floorings and refinished the wood floors in 1991.

Review of photos from the 1960s and 1990s indicate that the interior doors, trim, baseboards, and wainscot were painted (Figures 1C-16 and 1C-17). The paint analysis revealed that this paint was applied over a shellac/varnish finish. It is not currently known when it was painted. Many of the doors have been stripped and currently have a stain and varnish finish (Figures 1C-18).

PASSAGEWAY

Based on review of historic photos, it appears that the Passageway roof was replaced and the masonry walls painted concurrently at the same times as the Keepers' Dwelling.

The original exterior door on the west side of the passageway was removed at an unknown date. Though most of the historic photos of this door were taken from a distance, it appears that the door was a wood panel door, painted a dark color.

LIGHT TOWER

The exterior of the tower was encased in metal panels up to the watchroom level in 1900 (Figure 1C-01). The watchroom level was encased in 1905. The original windows were removed and porthole windows were installed in the metal casing outboard of the original window openings. The metal panels were painted black and white in the same configuration as remains today. The lantern was originally painted white (Figure 1C-01), but was later painted black (Figure 1C-19), as it remains today.

SITE FEATURES

There have been several flagpoles and birdhouses in different locations at the station. Many photos from the 1930s through 1960s show a large flagpole with a weathervane located west of the Keepers' Dwelling, south of the walkway to the original fog signal building (Figure 1C-19). This is the location it is shown on the 1944 and 1963 plot plans (Figures 1C-21 and 1C-22). The current flagpole is a tri-mast, nauticle-style flagpole located southwest of the Keepers' Dwelling (Figure 1C-20). This fagpole in this location first appears on photos from the late 1980s - early 1990s (undated photos that include the pole light tower).

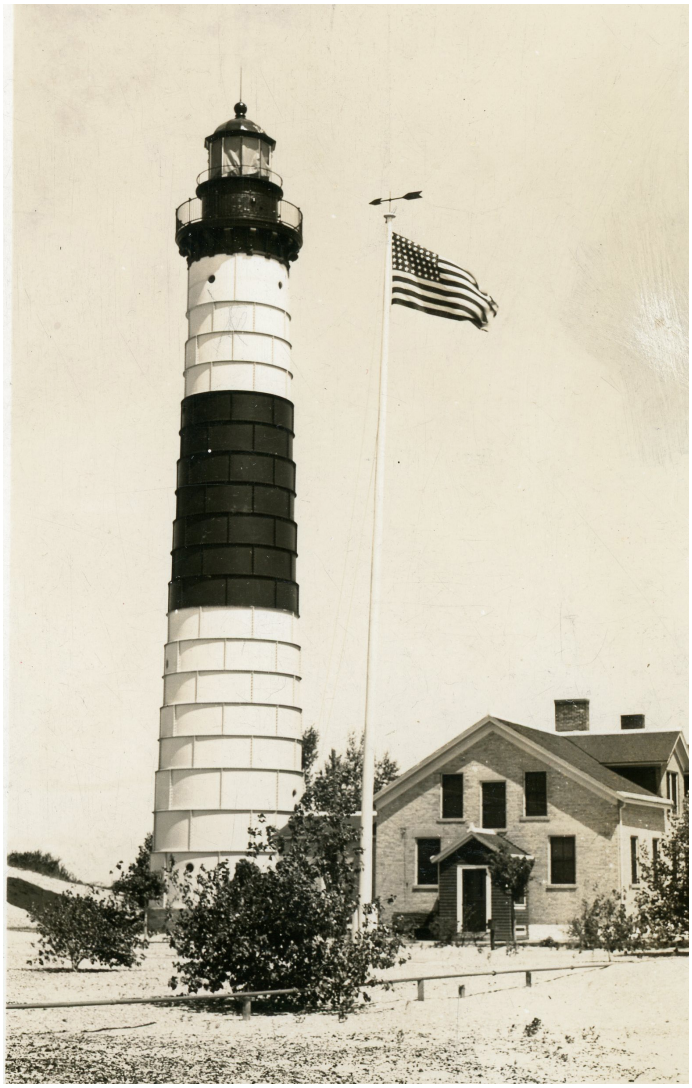

Figure 1C-19: Circa 1930 photo looking northeast with the large flagpole east of the Keepers' Dwelling.

Figure 1C-20: Circa late 1990s photo looking northeast with a flagpole south of the Keepers' Dwelling.

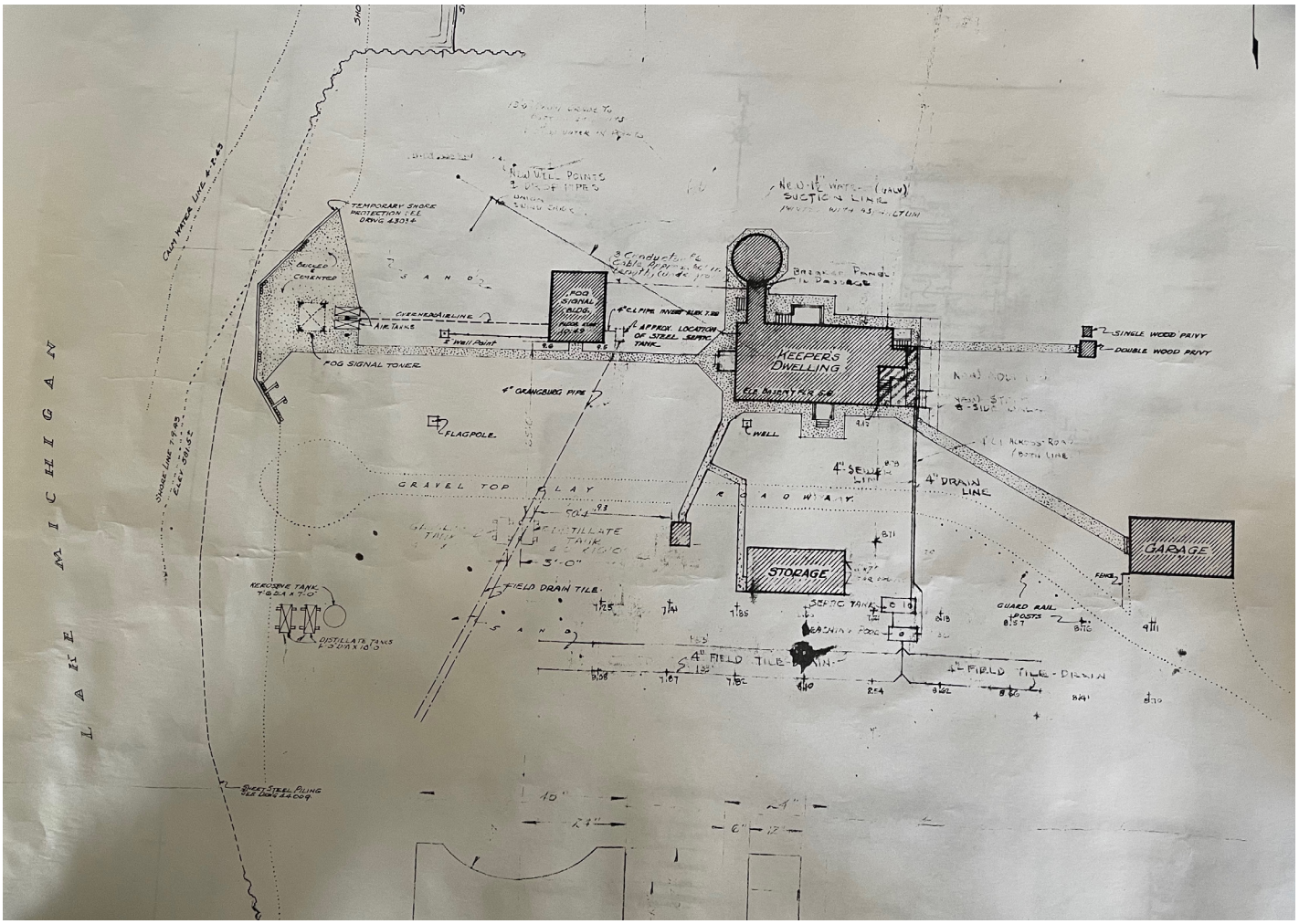

Figure 1C-21: 1944 plot plan of the light station.

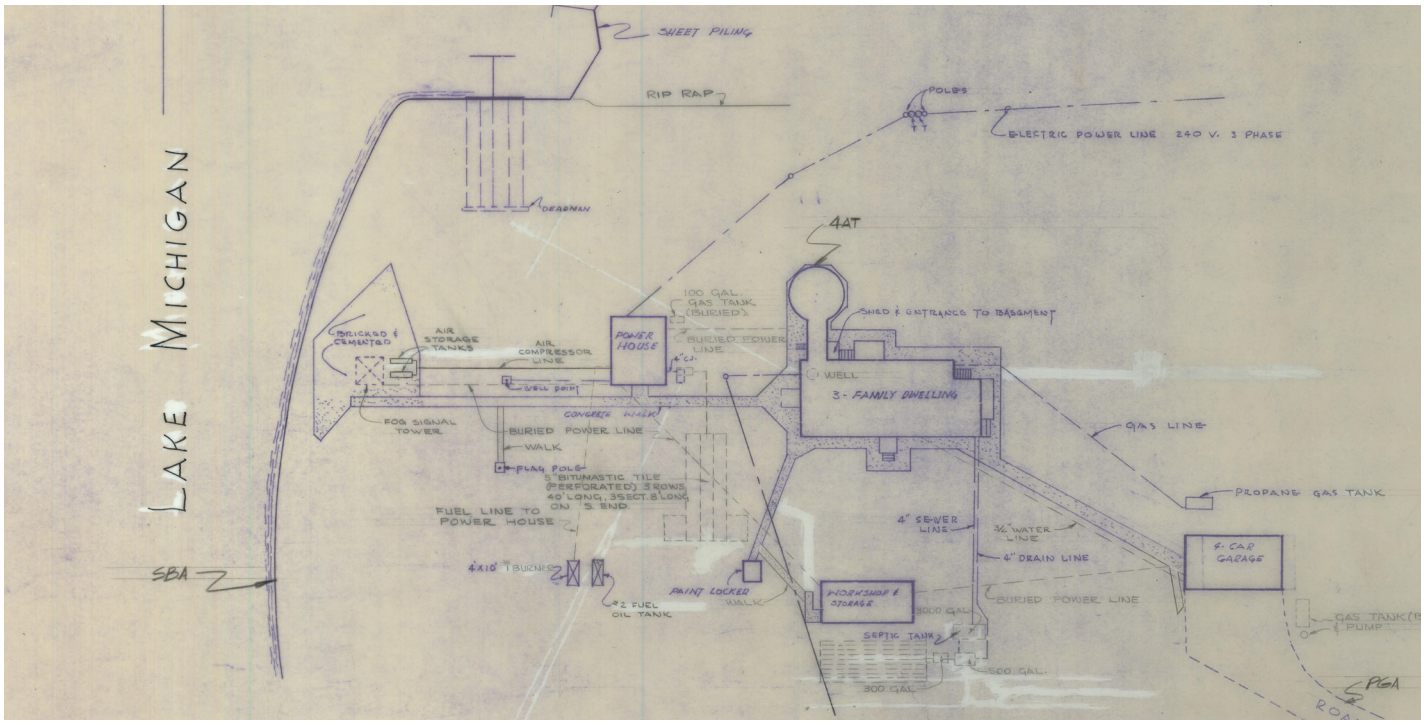

Figure 1C-22: 1963 plot plan of the light station.

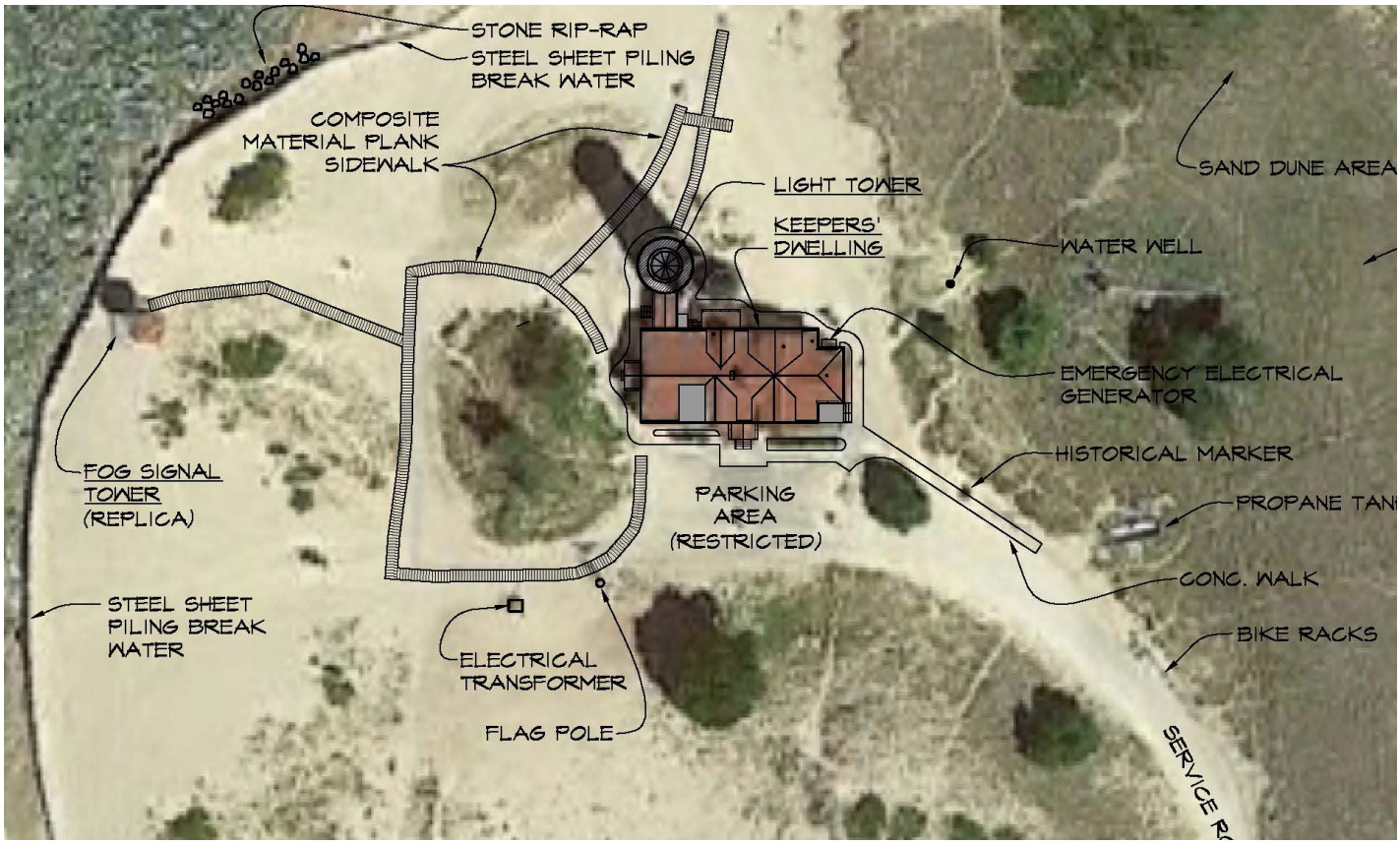

Figure 1C-23: Current site plan of the light station.

The first written documentation of a birdhouse is a March 1940 keeper's log entry that he/they were making a birdhouse for Martins. Figure 1C-24 is one of many photos including a Martin birdhouse at different locations at the station.

Figure 1C-24: 1941 photo showing a birdhouse west of the tower..

Figure 1C-25: Circa 1943 photo of Keepers Rogan and Fitchners' families by the water pump. The caption on the photo at the SPLKA archives says, "Water pump - Best Water!"

A water pump that was installed just south of the west end of the Keepers' Dwelling in 1909-1910 remains in the same location today (Figure 1C-25) . The antique-style lampposts installed in 1988 also remain in the same locations today.

The first walkways at the station were wood plank. Early photographs show wood walkways on timber cribbing around the Keepers' Dwelling and wood plank walkways extending west from the west entrance toward the shoreline (see previous Figures 1B-06 and 1B-15). These were likely built in conjunction with the dwelling or soon after. These walkways are shown on the 1883 survey site plan, as well as a walkway extending east from the dwelling (see previous Figure 1B-09). The latter walkway is shown extending alongside and past what is thought to have been a barn or storage building to the area where the privies were located. Wood walkways on timber cribbing were also built at some time around the Light Tower, as an 1899 report indicated that the timber platforms around both the dwelling and tower were rebuilt that year. Historic photos also show a wood walkway extending south from the Keepers' Dwelling to the small brick oil house circa 1905. The wood cribbing and walks were extended around the 1909 addition and porches and a walkway was built extending south from the east-west walkway west of the Keepers' Dwelling to the Fog Signal Building. A 1909 drawing shows that wood walkways were also built to the round oil house and to the barns (referred as sheds) east and south of the dwelling (Figure 1C-26).

The wood walkways were replaced with concrete walks in 1920. The new concrete walkways located around the perimeter of the Keepers' Dwelling and Tower, and those extending out toward the shore, Fog Signal Building, and the privies were built in the same locations and general configuration as the wood walkways. There was an angled concrete walkway extending from the southwest corner of the dwelling to the small brick oil house; with an extension from this walkway to the relocated

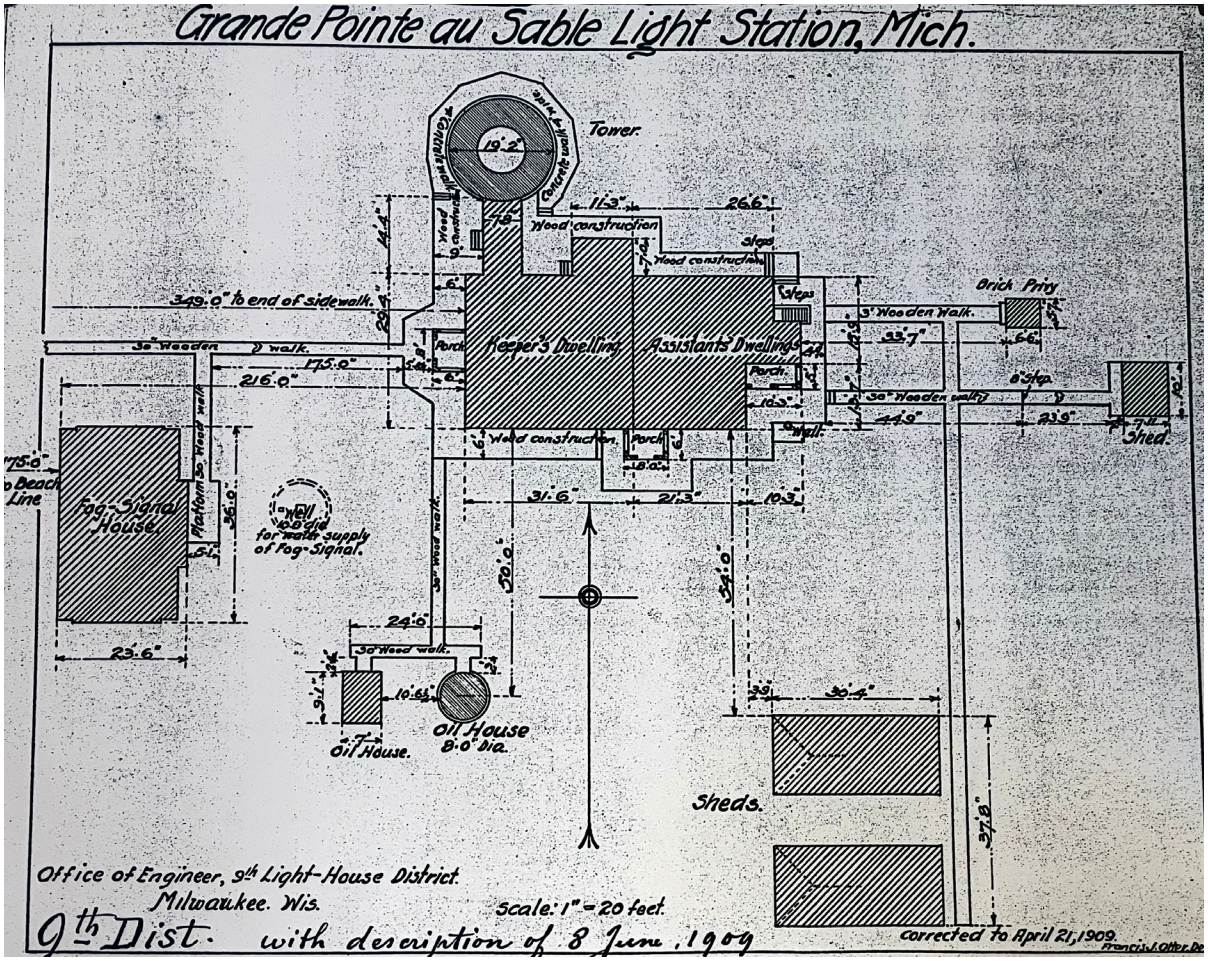

Figure 1C-26: 1909 plot plan of the light station.

boathouse that was converted into a workshop. Additional connecting walks were added to the Fog Signal Tower, Fog Signal Control Building, Workshop (relocated boathouse), Garage, and the flagpole when these structures were built (Figure 1C-21).

Except for the concrete walkway to the privies (which was likely removed when the privies were in the 1950s), the walkways remained through the mid-1960s (Figure 1C-22) and into the 1970s (Figure 1C-27). The concrete walkway around the base of the Light Tower collapsed along joint lines due to erosion in the 1980s (Figure 1C-28). Circa 1980s photos show that sections of concrete had been replaced around the Keepers' Dwelling and several areas were in poor condition with cracks and spalls (Figure 1C-29).

Based on review of photographs, it appears that the walkways around the Keepers' Dwelling and Tower, and the extension to the former garage were replaced in the late 1990s (Figure 1C-30). The replacement walkways are in the same general configuration as the original walkways, with a few exceptions (Figures 1C-22 and 1C-23). The new walkways south of the Keepers' Dwelling extend out further from the dwelling and have sandy, vegetation strips within them that are parallel with the building. The concrete walkway around the base of the Tower is curved, whereas the original walkway was segmented based on an octagonal shape. There is also a darker, inset concrete square border inset around the water pump. The concrete inside of this border appears to be an earlier vintage (Figure 1C-31). The current concrete walkways have an exposed aggregate finish. Historic photographs indicate that the original walkways had a smooth, floated finish. A portion of the concrete at the north porch entrance steps has this type of finish and was not likely replaced (Figure 1C-32).

Figure 1C-28: Circa 1980s photo of the collapsed concrete walkway around the base of the tower.

Figure 1C-29: Circa 1980s photo looking down at the Keepers' Dwelling from the tower.

Figure 1C-27: 1973 aerial photograph of the light station.

Figure 1C-30: Circa late 1990s photo looking northeast toward the Keepers' Dwelling showing the replacement concrete walkways.

The connecting walks to other outbuildings are not currently visible but may be present buried under sand. It appears that portions of former walkways may be used as some of the current rip rap north of the Tower (Figure 1C-33). Composite material planks are located north and west of the Keepers' Dwelling and Tower, and extending to the replica Fog Signal Tower (Figure 1C-23).

SHORELINE PROTECTION

Although there is limited written documentation, there are several photographs that show the evolution of shoreline protection at the station, as well as installation and modification over the years. The following is a summary.

Figure 1C-31: 2023 photo showing the patterned concrete around the water pump.

Figure 1C-32: 2023 photo showing the different concrete at the north side of the Keepers' Dwelling.

Figure 1C-33: 2023 photo of rip rap north of the tower that may be former concrete walkways.

Summer 1943
Temporary timber shore protection, backfilled and cement cap/platform constructed around the Fog Signal Tower

Late Summer 1943
The brick and cement cap began collapsing

Fall 1943
Curved steel sheet piling seawall constructed

1944
Rip rap installed at the north and south ends of the steel seawall

1960s
Additional sheet piling seawall and groins installed extending north from the original seawall

1970s
Rip rap installed in east-west direction, extending east from 1960s seawall extension

1982
Rip rap of concrete from the collapsed fog signal control building installed north of the tower (Figure 1C-33)

1984
Additional rip rap comprised of debris from the demolished garage and workshop installed north of the tower (Figure 1C-34)

1986
Sandbags installed north of tower (Figure 1C-35)

1989
Steel sheet piling seawall, with rip rap on water side, installed

1990s
Additional rip rip installed at north and south ends of seawalls

2012 - 2013
The steel sheet piling seawall was extended approximately 150 feet to the south

2019 - 2020
Much of the seawall cap destroyed by ice and wave action

2022
Seawall cap replaced (Figure 1C-36)

Figure 1C-34: Circa 1986 aerial photo showing the shore protection at that time.

Figure 1C-35: November 1986 photo showing sandbags being installed north of the tower.

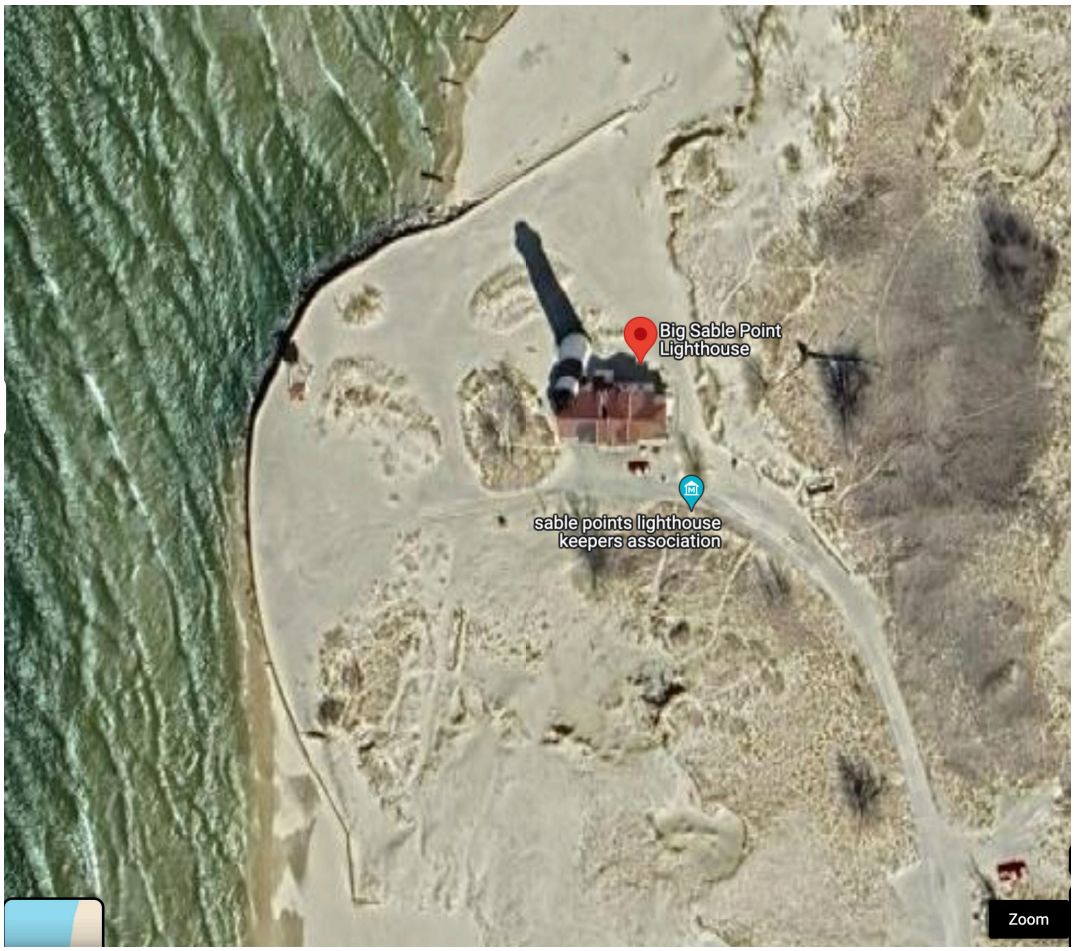

Figure 1C-36: 2023 Google Maps screenshot showing the current shore protection.

PERIOD OF SIGNIFICANCE

The Big Sable Point Light Station is listed on the National Register of Historic Places as part of the Multiple Resource Thematic nomination titled "United States Coast Guard Lighthouses and Light Stations on the Great Lakes." This listing includes fifty light stations located in Illinois, Michigan, Minnesota, New York, Ohio, Pennsylvania, and Wisconsin. As stated in the nomination for this listing:

> The theme of this nomination is the design and construction of lighthouses and light stations on the Great Lakes prior to 1930. The nominated buildings and structures were essential to the rapid expansion of the Great Lakes maritime commerce from the 1850s through the 1920s. They illustrate the evolution of lighthouse design and construction methods in response to changing requirements of Great Lakes shipping as the volume of traffic increased, routes changed, and the size and speed of ships increased.

Several criteria were used for inclusion in this thematic nomination. Lights which were significant to the growth of general navigation on the Great Lakes, specifically coastal lights, major harbor lights (e.g., in Chicago, Cleveland, and Buffalo), and reef/shoal lights were nominated. Less significant harbor lights were included if they incorporated innovative designs. Finally, the nomination includes several lights which are significant because of innovative construction techniques used in their erection. They were built in remote locations, most notably on isolated reefs and shoals.

The historical integrity of the surviving buildings was also a major criterion used for the selection.

The nomination includes the following reference of the general criteria for listing a property in the National Register of Historic Places and states that "In evaluating the significance of lighthouses on the Great Lakes, it is apparent that Criteria A and C are the most applicable."

In the National Register of Historic Places information leaflet, the general criteria for listing a property in the National Register of Historic Places are as follows:

"The quality of significance in American history, architecture, archeology, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association, and:

A. that are associated with events that have made a significant contribution to the broad patterns of our history; or

B. that are associated with the lives of persons significant in our past; or

C. that embody the distinctive characteristics of a type, period, or method of construction, or that represent a significant and distinguishable entity whose components may lack individual distinction; or

D. that have yielded, or may be likely to yield, information important in prehistory or history."

The specific dates of significance of the overall listing are 1832 – 1919. Following the criteria stated above, the nomination was based on the buildings and structures identified in the Historic American Engineering Record (HAER) Great Lakes Survey conducted for the United States Coast Guard in 1979. The HAER Inventory document prepared for the Big Sable Point Light Station lists the significant dates as 1867-1905. These dates are based on the construction dates of the original light tower/dwelling/passageway (1867) and the completion of the metal encasement of the tower (1905).

1867 should remain designated as a date of significance, as it was the year that the light station was established. Based on the analysis of historic documentation, additional dates of significance include 1909 (year fog signal established and Keepers' Dwelling expanded), 1941-1942 (years original fog signal building and large oil house collapsed, and new fog signal tower and control building built), and 1949 (addition and upgrades to the Keepers' Dwelling). The recommended period of significance is the entire time that the station was in operation with resident personnel: 1867 - 1971.

Recommended Period of Interpretation

Since its construction, the Big Sable Point Light Station has served only one purpose – to provide aids to navigation. As such, alterations have been limited to technological upgrades and subsequent modifications related to these upgrades (such as construction of new buildings and modifying structures for additional personnel that came to the station due to the technological upgrades). All of the structures contributed to the success of the station. Therefore, it is recommended that the period of 1949 – 1971 (Episode 5) be established as the Period of Interpretation. This is the period of time that includes the presence of all structures built at the light station with the exception of the 1909 Fog Signal Building and early barns. The configuration of the Keepers' Dwelling from this period remains today. This period also represents the last reduction in size of the lighthouse reservation.

1D Physical Description

Documentation of the existing conditions at the Big Sable Point Light Station was performed by Mr. Ken Czapski, a registered architect in Michigan and Ms. Cheryl Early, PE, of Wiss, Janney, Elstner Associates, Inc. (WJE), a licensed professional engineer in Michigan, during a site visit on July 18-21, 2023. Others present during this site visit include: Ms. Lindsay DeWeerd of WJE, Mr. Bob Ziman of Mihm Enterprises, Inc., and Ms. Michelle Smay of Smay Trombley Architecture. This section includes an assessment of the present-day conditions at the light station. Drawings of the existing present-day conditions are located in the Appendices.

GENERAL

The Big Sable Point Light Station is located on the Lake Michigan shoreline in Ludington State Park, north of the city of Ludington, Michigan. Situated within a remote area of the 5,000-acre park, the boundaries of the light station site are not physically defined. The light station currently consists of the iconic Light Tower which is connected to the Keepers' Dwelling by a Passageway, a replicated Fog Signal Tower, and a newer building for public restrooms. The Light Tower, Passageway, and western portion of the Keepers' Dwelling were constructed in 1867 with modifications made through the 1940s. The site was listed in the National Register of Historic Places in 1983.

Although once vacant and vandalized, volunteers have since restored the Keepers' Dwelling and Light Tower. The volunteer group has also constructed the replica Fog Signal Building. An active residency program within the Keepers' Dwelling provides staffing for a gift store and allows the public access to the lantern level of the Light Tower from April to October each year. The 112-foot-tall Light Tower is connected to the Keepers' Dwelling with the single-story Passageway extending between the light tower and the western end of the north facade of the Keepers' Dwelling (Figure 1D-01). The approximate 2,000 square-foot, rectangular footprint of the Keepers' Dwelling is comprised of the original, western structure and two eastern additions. There is a garden-level basement space, currently used for storage, below the entirety of the footprint of the Keepers' Dwelling. The main level of the Keepers' Dwelling is divided into eastern and western halves; the western half is opened for the public gift shop and the eastern half is used as a living area for the residency program. Additional living space is located at the second-floor level, constructed within the overall depth of the roof structure.

Figure 1D-01 Overall Keepers' Dwelling north elevation.

Figure 1D-02 Overall Keepers' Dwelling south elevation.

Figure 1D-03 Fog signal tower replica south of the shadow of the light tower, as viewed through the light tower portal at grade.

Figure 1D-04 View of the site looking north towards the light station.

Figure 1D-05 View of the site from the Light Tower looking west.

Figure 1D-06 View of the site from the Light Tower looking south.

Dormers located on both the north and south facades provide natural light and an increased living area for the second-floor spaces (Figure 1D-02). The replica Fog Signal Tower is located between the Keepers' Dwelling and the seawall at the water's edge (Figure 1D-03). The newer, public vault toilets are located along the access road just south of the Keepers' Dwelling; the vault toilets were excluded from this assessment.

The original masonry of the Tower, Passageway, and Keepers' Dwelling is reportedly constructed with Milwaukee Cream City brick, a brick known for its poor durability in exterior lakeshore environments. At the beginning of the twentieth century, the exterior of the tower was clad with metal cladding to protect the masonry from further damage. Coatings have been applied over the exterior surface of the brick masonry of the Passageway and Keepers' Dwelling. Punched window and door openings are of sizes and locations typical of this era of construction. The asphalt shingle roofing completes the overall building envelope of the Passageway and Keepers' Dwelling. The floor and roof structures consist of full-sawn dimensional lumber.

SITE

The site of the Big Sable Point Light Station is a freshwater coastal dune environment with blowing and drifting sand and unique vegetation (Figures 1D-04, 1D-05 and 1D-06). Access to the Lighthouse is via a one-and-a-half-mile sand and gravel service road that is entered from the Pines campground area (Figures 1D-07,1D-08 and 1D-09). The road terminates in front of the Keeper's Dwelling in a small parking area with picnic tables placed in this area for visitors (Figure 1D-10). Vehicle traffic on this road is restricted to service and staff vehicles and small buses during special events, with visitors typically walking or bicycling to reach the Lighthouse. The lack of vehicles parked around the Lighthouse enhances the historic feeling of the site and one of remoteness.

Figure 1D-07 Light station access road through the dunes.

Figure 1D-08 Access road with public vault toilets.

Figure 1D-09 Access road.

Figure 1D-10 Termination of access road at the Keepers' Dwelling.

Along the service road, approximately one-eighth mile from the Lighthouse, there are two Vault Toilets for public use (Figures 1D-11 and 1D-12). These two toilets are the only public facilities and are replicas of toilets that were once at the site. The interior and some graphics explaining the buildings are shown (Figures 1D-13 and 1D-14).

With the popularity of bicycling, there are a number of bike racks along the service road near the Lighthouse for visitor use (Figure 1D-15). On a small sand dune near the bike racks is a fenced enclosure that contains a propane tank and a small satellite dish (Figures 1D-16 and 1D-17). A single flagpole is located at the west edge of the parking area near the Lighthouse (Figure 1D-18). Other site amenities include both concrete sidewalks (Figures 1D-19 and 1D-20) and composite material plank sidewalks (Figure 1D-21) that allow visitors to follow designated paths through the soft sand.

The concrete walkways around the Keepers' Dwelling and Tower, and the extension to the former garage location are in overall good condition. There are few localized, minor cracks and there is some overgrown vegetation at some joints, cracks, and adjacent to foundation.

Figure 1D-11 South and east elevations of the public Vault Toilets.

Figure 1D-12 West and north elevations of the public Vault Toilets.

Figure 1D-13 Interior of Vault Toilet.

Figure 1D-14 Signage inside the Vault Toilet.

Figure 1D-15 Public bike racks along the access road.

Figure 1D-16 Small fenced enclosure around propane tank and satelite dish.

Figure 1D-17 Satelite dish and fenced enclosure.

Figure 1D-18 Flagpole south of the Keepers' Dwelling.

Figure 1D-19 Concrete sidewalks around the Keepers' Dwelling.

There is a limited amount of signage at the site. A Michigan Historic marker (Figures 1D-22 and 1D-23) is located along the service road at the approach to the Lighthouse and an information kiosk is located at the west end of the Keepers' Dwelling near the public entry to the gift shop (Figure 1D-24). Also on the west wall is a small plaque stating that the 1867 Light Station is listed on the National Register of Historic Places (Figure 1D-25). A small signpost (Figure 1D-26) designates the site as part of the Mason County Maritime Heritage Trail with instructions for exploring the trail with a cell phone. Other signage includes an informational sign at the replica Fog Signal Tower (Figure 1D-27) and various Department of Natural Resources trail marker signs (Figure 1D-28).

Similar to other light stations, there once were other buildings at the site that are now gone. The only other structure, other than the Vault Toilets, is the Fog Signal Tower that is a reconstruction. The Fog Signal Tower, located near the shoreline, is a small wood frame structure with a wood shingle roof that rests on a skeletal steel frame (Figures 1D-29, 1D-30 and 1D-31). Replica diaphones face the lake. The interior of this building was not accessible and is not included in this report. As a newer structure, the exterior is in good condition. A brief structural assessment is included at the end of this section.

To protect the site from high water erosion, there is a steel sheet pile breakwater that extends a considerable distance around the site (Figures 1D-32 and 1D-33). The steel sheet piling is capped with a steel C-channel. Stone riprap is present in front of a portion of the wall.

Other site features, including electrical service, water, and sanitary, are discussed in a later section of this report.

Figure 1D-20 Concrete sidewalks around the Keepers' Dwelling.

Figure 1D-21 Composite material plank sidewalks around the north side of the Light Tower.

Figure 1D-22 East face of the Michigan Historic Site marker.

Figure 1D-23 West face of the Michigan Historic Site marker.

Figure 1D-24 Information kiosk at the public entry to the Gift Shop on the west end of the Keepers' Dwelling.

Figure 1D-26 Mason County Maritime Heritage Trail marker.

Figure 1D-25 National Register of Historic Places plaque on the west wall of the Keepers' Dwelling.

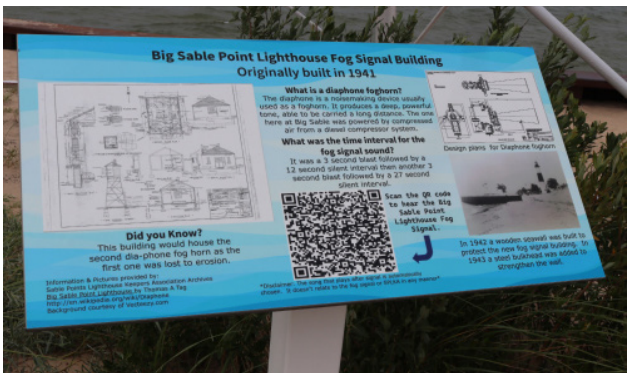

Figure 1D-27 Fog Signal Tower informational sign.

Figure 1D-28 Department of Natural Resources trail marker.

Figure 1D-29 Fog Signal Tower as viewed from the Light Tower.

Figure 1D-30 East elevation of the Fog Signal Tower.

Figure 1D-31 South and west elevation of the Fog Signal Tower.

Figure 1D-32 Steel sheet pile breakwater.

Figure 1D-33 Steel sheet pile breakwater and stone rip-rap.

KEEPERS' DWELLING

General

The present-day dwelling is a large one-and-one-half story masonry and wood frame building that is used as living quarters and a gift shop. The west part of the dwelling was constructed in 1867 as the original Keeper's Dwelling that was attached to the Light Tower with the single-story Passageway. In 1909 a major addition was constructed on the east as the Assistant Keeper's Dwelling. North (Figure 1D-34), West (Figure 1D-35), South (Figure 1D-36) and East (Figure 1D-37) elevations are seen in various photographs. Today, the entire second floor is connected and contains living and sleeping quarters for volunteer lighthouse keepers and the first floor contains a Gift Shop on the west end and a separate single bedroom living unit on the east end that is used by volunteers and others for overnight accommodations. The Gift Shop also serves as the entry point for staff, volunteers, and visitors to the Passageway and Light Tower. The unfinished basement is used for general storage and mechanical-electrical services. The Keepers' Dwelling is not barrier-free accessible.

STRUCTURAL SYSTEM AND ANALYSIS

Basement Level

The center masonry bearing wall and the common wall between the west and east halves of the structure separate the basement level into four primary quadrants. Throughout the basement, the concrete slab-on-ground is cracked and heaved upward with the greatest magnitude of distress of 1-1/2 inches along a 30-inch length located in the center of the southwest quadrant of the basement level (Figure 1D-38). The slab-on-ground was sounded and determined, in general, to have voids below the slab where the slab is displaced. The vertical displacement of the slab-on-ground is visible in the wood framing of the stair between the basement and main floor in this area with unlevel treads (Figure 1D-39), but no gaps or unpainted surfaces are present in the stair indicating the movement was present at least prior to the last re-painting of the stair.

The western, original 1867 portion of the Keepers' Dwelling is constructed atop stone masonry foundation walls. Loaded storage shelves prohibited full access to assess the foundation walls. A coating has been applied to the interior surface. The mortar was non-friable where it was accessible and the coating thin or missing. Vertical cracking was observed in the uppermost courses (Figure 1D-40) and step cracking at lower courses in the center bearing wall (Figure 1D-41). The stone masonry located below the wood stair in the southwest quadrant is in excellent condition with no distress observed.

Figure 1D-34 North elevation of the Keepers' Dwelling.

Figure 1D-35 West elevation of the Keepers' Dwelling.

Figure 1D-36 South elevation of the Keepers' Dwelling.

Figure 1D-37 East elevation of the Keepers' Dwelling.

Figure 1D-38 Cracked and heaved slab on ground in southwest quadrant of basement of keepers dwelling

Figure 1D-39 Unlevel stair treads at basement stair in southwest quadrant of basement.

Figure 1D-40 Vertical cracking in upper courses of center stone masonry bearing wall.

Figure 1D-41 Step cracking in center stone masonry bearing wall behind storage shelves.

The eastern portion of the Keepers' Dwelling is constructed atop brick masonry foundation walls. Similar to the western half of the basement, storage of materials prevented full access to the foundation walls for assessment. The coating on the interior surface of the brick is missing and/or peeling at the south wall; the brick faces are spalled; and efflorescence is present indicating moisture is present within the thickness of the foundation wall (Figure 1D-42). A horizontal crack, 1/16" (1.5 mm) in width, is present at mid-height of the south brick masonry foundation wall near a utility pipe which is anchored into the wall along the length of the wall (Figure 1D-43). Minor step cracking is present in the center brick masonry bearing wall (Figure 1D-44) and is likely related to utilities penetrating the wall in this area. A portion of the northern brick foundation wall and an interior brick masonry partition wall have been underpinned with a concrete foundation (Figure 1D-45). The date and reason this underpinning was installed is unknown and undocumented.

Concrete masonry unit (CMU) partition walls create a storage space in the southeast corner of the northwest quadrant of the basement. Cracking is present in the CMU partition walls, likely due to inadequate foundations below the moderately heavy partition walls.

Access was not obtained to the exterior cellar door stairwell, below the outward projection from the north wall located just east of this exterior cellar door stairwell, or below the covered entrances on the west and south facades.

Discussion

The upward displacement of the floor slab is likely related to hydrostatic pressure and/or freezing of any moisture below the slab during the lifetime of the slab-on-ground and may have occurred when the structure was vacant and unheated. The heaving may also be related to shifting inward of the perimeter basement walls compressing and lifting the slab-on-grade as a result of soil pressures acting on the basement walls. However, related cracking was not observed on the exterior of the building indicating movement of the foundation walls. Removal of the storage shelves to allow full access to the perimeter walls will allow for further assessment. The distress has been present, at least, since before the stairs were last painted based on the condition of the stairs. Monitoring of the displacement is recommended; if moisture is observed to penetrate the basement space through the cracks, if changes in the magnitude of the cracks are recorded, or more cracks develop, this signals that the cracking is active, and further investigation may be warranted. Repair or replacement may be desirable to reduce a tripping hazard at this level.

Minimal cracking observed in the south brick masonry foundation wall of the eastern portion may be related to excessive soil pressures acting on the exterior surface of the existing wall, migration of water freezing and thawing within the wall potentially exasperated due to the applied coatings, or distress related to the multiple utilities anchored into or penetrating through the walls. Cracking in the interior center-bearing walls is suspected to be related to localized settlement of the foundations or penetrations from utilities. All the cracking is relatively minor in magnitude and can be repaired, which would set a baseline to reference for annual monitoring of the walls.

Figure 1D-43 Horizontal crack in south brick masonry foundation wall.

Figure 1D-42 Missing and peeling coating, efflorescence present on south brick masonry foundation wall.

Figure 1D-44 Minor step cracking in brick masonry center bearing wall.

Figure 1D-45 Underpinning present in north brick masonry foundation wall.

First and Second Floors

The floors are constructed with rough-sawn 2x10 joists spaced at a regular 16-inch spacing with 1x cross bridging located within the span on the west half; and nominal 2x10 joists at the same 16-inch spacing without 1x cross bridging located within the span on the east half. The joists are pocketed into the masonry foundation walls (Figure 1D-46); the bearing of the second-floor joists is unconfirmed. The floor assembly consists of, from top down, finish tongue and groove floorboards, on diagonally oriented subfloor boards, on the floor joists which support the wood lathe and plaster ceiling of the area below. The finish floorboards in the western portion of the Keepers' Dwelling are oriented north-south; in the eastern portion, the boards are oriented east-west.

A one-inch in four-foot length slope down to the west was measured in the northwest quadrant first floor level (Figure 1D-47). No gaps in the flooring, trim, or other attached features were observed in the area of the floor slope. At the east end of the Keepers' Dwelling, a gap is present between sections, likely from two vintages of installation; the boards are discontinuous at this location (Figure 1D-48).

The southeastern enclosed porch at the first-floor level is constructed with a reinforced concrete slab (**Figure 1D-49**). Steel reinforcing is visible in openings on the underside of the slab due to poor consolidation of the concrete during original construction (Figures 1D-50 and 1D-51). The bottom bars are oriented in the long direction of the slab and are spaced 8-1/2 inches on center where exposed with an approximate ½-inch (15 mm) concrete cover depth.

Figure 1D-46 Floor joists bearing at south brick basement wall; note diagonal subfloor and wood blocking between joists.

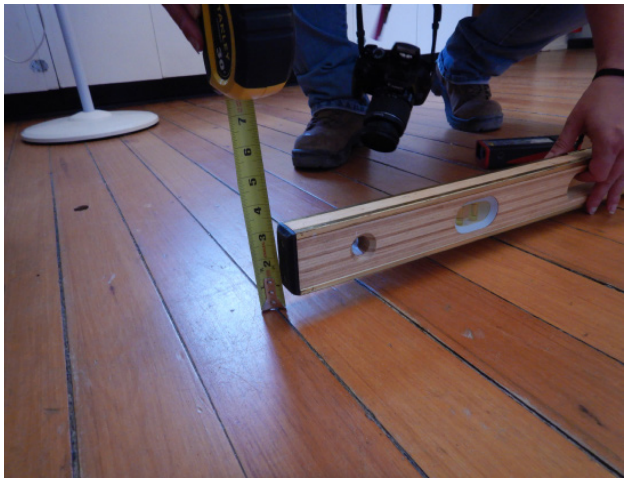

Figure 1D-47 First floor in the northwest quadrant of the dwelling slopes down to the west.

Figure 1D-48 Delineation of finish floor boards at first floor level, east end.

Figure 1D-49 Top surface of concrete slab in southeast corner of Keepers' Dwelling first floor level.

Figure 1D-50 Underside of concrete slab at southeast corner vestibule above; note condition of brick on east and south exterior walls of this basement level storage room.

Figure 1D-51 Steel reinforcing visible where concrete was poorly consolidated during original construction.

A mix of painted gypsum board or plaster is present on the walls and ceilings of the interior spaces, depending upon location. Separations are common in wall-to-ceiling joints (Figure 1D-52), especially at the second-floor level where the ceiling is connected directly to the underside of sloped roof rafters (Figure 1D-53). Cracking at door and window corners (Figure 1D-54), in the ceiling near the center of rooms (Figure 1D-55), and in the ceiling between interior wall corners (Figure 1D-56) are common. Some of the cracks have been repaired previously and have re-opened (Figure 1D-57).

Figure 1D-52 Separation at ceiling and cupboard, and at ceiling and wall in first floor eastern kitchen space along east wall.

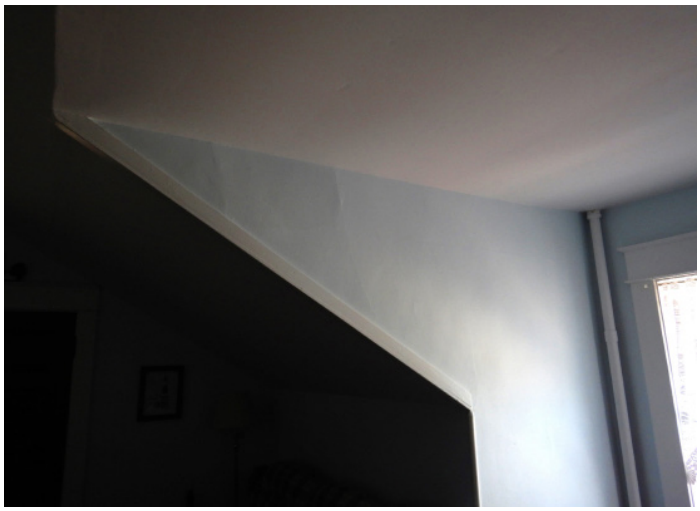

Figure 1D-53 Cracking in west wall of north dormer at second floor living area.

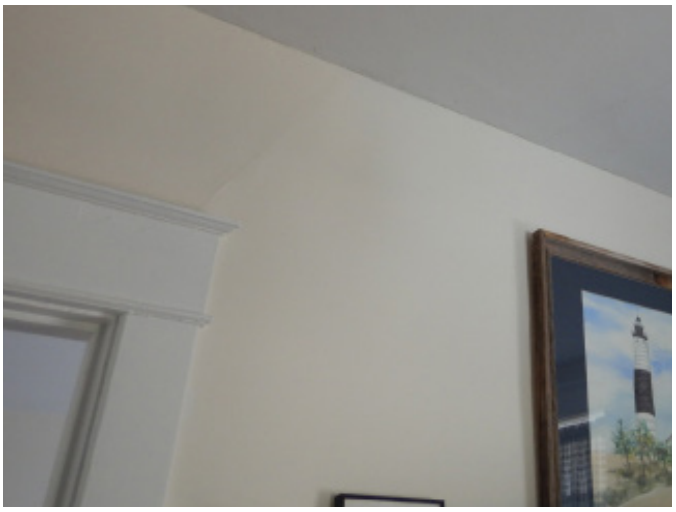

Figure 1D-54 Cracking in ceiling near center of room and extending up from corner of door.

Figure 1D-55 Cracking in ceiling near center of room and extending up from corner of door.

Figure 1D-56 Cracking between interior partition walls in ceiling.

Figure 1D-57 Cracking reoccurred after previous repair attempt.

Discussion

The floor slopes observed have been present at least prior to the renovation of the rooms in the area of the floor slope, else the trim and cupboards would exhibit gaps or other distress. The discontinuity of the finish floorboards relates to the last eastern addition of the Keepers' Dwelling. Although the cracking in the wall and ceiling finishes are prevalent throughout, due to the general assembly and seasonal use of the building, the cracking is likely related to the relative stiffness of the roof structure when it is supporting snow versus when it is supporting only its own weight. The reoccurrence of cracking at previously repaired areas suggests the cracking is a seasonal distress. The cracking can be repaired in a manner to allow seasonal movements, or the repair can be repeated each spring. Continue to monitor the cracking locations for indications of greater structural concerns.

Roof Structure

The roof structure is partially accessible through second-floor level ceiling hatches in both the east and west halves of the building. Both roof structures consist of dimension lumber framing representative of the era of construction with full-sawn 2x6 members at 16-inches on center at the older, west half (Figure 1D-58), and nominal 2x6 members at 16-inches on center at the east half (Figure 1D-59). The ceiling joists are serving as cross ties between the gabled rafters which frame into a ridge board. The roof sheathing is

Figure 1D-58 Roof framing at ridge of west half of Keepers' Dwelling; note skip-board 1x sheathing.

Figure 1D-59 Roof framing at ridge of east half of Keepers' Dwelling; note single nominal 2x members at dormer framing each side.

of skip plank construction on the west half, and 1x board construction on the east half. Although some boards are water stained, the water staining appears to be old and is not consistent in the localized areas, indicating the water staining may be related to the use of the lumber prior to its current installation. White staining of some of the roof boards supports the salvaged lumber use theory (Figure 1D-60). The valley members for the dormers are single members. The east end of the roof is hipped respective to the primary gable system. A single rafter in this hipped framing is cut short of its bearing on the brick masonry wall and is spliced with another partial-length rafter that is bearing on the brick wall (Figure 1D-61). Extensive water staining is visible at the header for the south dormer at the east half of the building (Figure 1D-62). A time capsule to be opened after 2042 is located in the east attic space.

The center masonry demising wall between the east and west halves of the building provides a high point along the roof on the exterior. Especially to the east, the roof, both along the ridge and along the span of the rafters, sags downward respective of this demising wall (Figure 1D-63).

Figure 1D-60 Difference of color in skip-board sheathing at west half of roof; rafters are tight to ridge board.

Figure 1D-61 East rafter at hipped section of roof is spliced within span; note the time capsule on right side of photo.

Figure 1D-62 Extensive water staining at south dormer framing at east half of roof.

Figure 1D-63 Sloping of roof adjacent to center masonry demising wall at chimney on eastern portion of the Keepers' Dwelling.

Discussion

The water staining at the south dormer at the east half of the roof is recommended to be further investigated but is likely related to flashing failures around the transition in the roof at the dormer. Members spliced within the span of the rafters are recommended to be reinforced with 2x members extending full length. Due to limits on access to these areas, this further investigation and reinforcement may be best achieved during the next re-roofing effort, pending no further distress is exhibited prior.

The skip-board sheathing on the west half of the building relates to the original cedar shingles installed on the roof. The sheathing is continuous on the east half of the building, potentially indicating that the cedar shingles were removed when the east half was constructed.

The downward slope of the roof structure relates to the natural creep of the wood framing members in comparison to the stiffer demising bearing wall and the snow drift loads which likely accumulate on the northern portion of the roof between the dormers. Additionally, the eastern roof structure mimics the original, western roof structure, but the lumber in the eastern half is smaller in actual dimension than the full-sawn lumber used in the western portion. An analysis of this roof structure for these drift loads may determine that strengthening of the rafters may be advised.

Exterior

The exterior walls are of two and three-wythe, brick masonry with stone headers over the window and door openings. The soffit conceals the headers over the second-floor level windows on the east facade. Header courses are visible in locations suspected to be original masonry, and occur every eight courses on average. At the eastern addition, header courses are visible every twelve courses on average. Header courses are not visible in the areas known and believed to have been rebuilt, such as at lower portion of the west end of the south elevation.

The coating on the outboard surface of the exterior walls is trapping moisture within the wall assembly; the coating is peeling and bubbly in multiple locations. Organic growth was observed between the coating and brick at select locations (Figure 1D-64). Where the coating is peeling from the brick, both reddish and buff-colored brick are exposed and at least two different colored and textured mortars were observed. In most of these locations,

Figure 1D-64 Organic growth located between the brick masonry exterior face and the exterior coating.

Figure 1D-65 Exposed red, spalled brick at east end of north façade where coating is missing.

Figure 1D-66 Buff colored brick spalling where coating is peeling off of exterior surface of wall.

the coating failure is occurring within the brick assembly (the brick and/or mortar are spalling with the coating bonded to the spalled portions) (Figures 1D-65 through 1D-68). The coating has been applied over previously spalled brick based on the surface texture of individual bricks (Figure 1D-69, 1D-70 and 1D-71). Additionally, evidence of past repair attempts is visible in select areas where the coating has de-bonded from the masonry (Figure 1D-72). Where exposed, the mortar is primarily of a light brown color with sand aggregates visible to the unaided eye, although two other mortar colors were observed at areas of coating distress on the north facade. The mortar was sound, and generally non-friable where rubbed. Mortar is missing around one brick on the south face of the chimney, almost as if the mortar was purposefully removed for a repair of the masonry which was left unfinished (Figure 1D-73).

Figure 1D-67 Damaged buff colored brick behind coating which was peeling off of exterior surface of wall.

Figure 1D-68 Portions of buff colored brick bonded to coating from area shown in Figure 1D-67, note two different mortars also bonded to removed exterior coating.

Figure 1D-69 Coating applied over spalled brick.

Figure 1D-70 Coating applied over spalled brick.

Figure 1D-71 Coating applied over spalled brick.

Figure 1D-72 Coating (on bottom surface of sample this photo) applied over cementitious fill over red brick (top surface of sample this photo).

Figure 1D-73 Mortar around brick in chimney missing.

Minimal cracking was observed in the masonry walls. Step cracking, of approximately 1/16" (2 mm) or less in width, is located on the east facade north of a basement window (Figure 1D-74), the east end of the north facade relative to the upper corner of the eastern window (Figure 1D-75), and on the south facade above the westernmost, first-floor window (Figure 1D-76).

Along the north facade, the brick foundation of a single-story projection, originally constructed as an enclosed porch, is visibly displaced outward 1-1/4-inches (Figure 1D-77). This area is noted to be unexcavated with 2x wood floor joists at the first-floor level; indicating the joists are likely located over a shallow crawl space. Headers are not present in the exterior wythe of the running bond masonry. Mortar was observed to be missing in the joints nearest grade level and at least one brick could be shifted by hand. This brick was removed with little effort and approximately four measuring cups of wet sand was removed from behind and around

Figure 1D-74 Step cracking on east facade, north of basement windows.

Figure 1D-75 Cracking extending between eastern corner of window and roof level at north facade.

Figure 1D-76 Step cracking along edge of stone masonry lintel at the western end of the south facade.

the removed brick (Figure 1D-78). Vegetation was rooted in the sand behind the brick (Figure 1D-79). When probed, the next interior wythe could be felt, but it was not exposed for visual verification due to the amount of sand that continued to collect in this inspection opening.

The first-floor level is raised approximately 4 feet above exterior grade requiring steps at all

Figure 1D-77 Visibly displaced outward brick foundation wall of single-story projection on north facade.

Figure 1D-78 Sand obtained from behind the loose brick when brick was removed.

Figure 1D-79 Vegetation rooting in sand directly behind loose brick.

entrances. Except at the west entrance where a wood framed vestibule is present, the steps are either painted stone or concrete, atop concrete or brick masonry foundations (Figures 1D-80, 1D-81 and 1D-82). Spalled areas and cracking are present in many of the steps. Painted, metal, 1-1/2-inch diameter, rail bars are anchored into the top or side surfaces of the steps and into the adjacent building framing.

Discussion

The organic growth behind the exterior coating and brick spalling with the coating bonded to the spalled pieces indicate that moisture is trapped within the wall assembly. The coating layers are likely the layers preventing the vapor transmission and dissipation through the wall assembly; interior wall treatments may also be affecting the behavior of the wall. During the winter months, the trapped moisture freezes, expands, and cracks the brick just beyond the protective, fired face of the brick. With sufficient cracking, the brick face then spalls, further exposing the brick masonry to additional moisture infiltration and an accelerated rate of degradation. Based on the known durability concerns of the original brick masonry, the brick has likely been coated for most of its life. The question now is if the current coating systems are proper. Further investigation into the appropriateness of the coatings and interior finishes in this application is warranted.

Masonry repairs can be completed when the existing coating is removed, the mortar joints repointed, and an appropriate, new coating system is reapplied. Masonry repairs should consider and be compatible with strength, density, and absorptive qualities of the existing masonry. "Patching" the existing masonry with a cementitious mix is not recommended as a long-term repair method. The relatively minor surface spalls are not of significant structural concern, especially compared to the reduced durability of the brick material. The exterior wythe,

Figure 1D-80 North stairs up to first floor level of Keepers' Dwelling.

Figure 1D-81 East stairs up to first floor level of Keepers' Dwelling.

Figure 1D-82 South stairs up to first floor level of Keepers' Dwelling.

where header courses are not present, can be reconstructed with header courses or stainless steel helical ties can secure the exterior wythe to the interior wythes.

The brick foundation of the single-story projection on the north facade requires reconstruction. It is unclear if the sand observed between the masonry wythes is driven from the beach into the masonry or if the sand is settling outward from the soil behind the walls and below the wood-framed first floor. Removal of wood floorboards on the first floor of this room will help reveal the floor structure to further evaluate the conditions. Temporary shoring and bracing of the superstructure will be required to rebuild the brick masonry foundation of this projection.

The painted metal rail bars and their anchorage likely do not meet current code requirements but may not be required to meet the requirements as an existing condition. Should modification of the stairs or rails be desired in the future, consideration to upgrade the rails to meet current code requirements is advised. Continue to maintain the steps to prevent any tripping hazards from spalled or cracked sections of the steps.

Exterior Conditions and Analysis

Exterior materials on the Keepers' Dwelling include asphalt shingle roofing, brick with a paint finish, wood trim with a paint finish, and wood shingle siding also with a paint finish. Some small flat or low slope roof areas have single-ply membrane roofing. Most exterior materials are in fairly good condition due to ongoing maintenance and care by the preservation group.

The "red" three-tab asphalt shingle roof (Figure 1D-83) was installed in 2017, and appears in reasonably good condition. A black, single-ply Ethylene Propylene Diene Monomer (EPDM) membrane and vertical membrane flashing on the masonry walls is present on three low-slope roof areas including the low-slope dormer on the south roof (Figure 1D-83), the porch roof on the southeast corner (Figures 1D-84 and 1D-85) and the basement stair enclosure on the north (Figure 1D-86). These EPDM roofs were also installed in 2017. There was no evidence of active roof leaks in the second floor and no roof leaks reported by staff. There are, however, some missing shingles on the north side of the roof. Wood snow guards (Figure 1D-87) were installed during the 1990s roof replacement to replicate the historic Yankee gutter system. Wood ridge boards were also installed to match the historic metal ridge boards. The mock Yankee gutter and decorative ridge boards were replicated as part of the 2017 roof replacement (Figures 1D-87 and 1D-88). The paint finish on many of these wood elements is in poor condition. Without removal, it is not known if there are any layers of previous roofing material below the asphalt shingles on the building.

Figure 1D-83 Asphalt shingle roof of the Keepers' Dwelling and Passageway as seen from the Light Tower.

Figure 1D-84 EPDM roof on the Southeast Porch.

Figure 1D-85 EPDM roof on the Southeast Porch.

Figure 1D-86 EPDM roof on the Basement stair enclosure on the north side.

Figure 1D-87 Wood snow guards.

Figure 1D-88 Decorative wood ridge boards.

A brick masonry chimney (Figures 1D-89 and 1D-90a) with three flues is centrally located and penetrates the main ridge of the dwelling. The chimney is approximately 1 foot 4 inches wide by 4 feet 0 inches in length and is capped with concrete. Two flues are capped with a decorative clay tile flue while the center flue is capped with metal (Figure 1D-90). The chimney base is flashed with metal. The brick masonry is in poor condition with deteriorated mortar joints and spalled brick faces. The paint finish is in very poor condition.

There are no gutters on the Keepers' Dwelling, but there are metal downspouts in a number of locations that terminate in the soffit (Figure 1D-91 and Figure 1D-92), indicating that there were likely built-in gutters in the roof. The non-functional gutters connect to below-grade drainage piping. The wood fascia, soffit, and metal drip edge are also seen in these photos. Fascia and soffits are in good condition, however, the paint finish in many areas is in fair condition.

Figure 1D-90A View of chimney from the Light tower.

Figure 1D-90 Deteriorated brick and paint on the brick masonry chimney.

Figure 1D-89 Deteriorated brick and paint on the brick masonry chimney.

Figure 1D-91 Non-active metal gutter terminating in the soffit.

Figure 1D-92 Non-active metal gutter terminating in the soffit.

The exterior masonry wall surfaces on the Keeper's Dwelling are brick with all surfaces painted. Although the building has a stone foundation, the stone is not exposed on the exterior. The 1867 west part of the dwelling is constructed of yellow brick and the 1909 east part is constructed of red brick. The brick surfaces are in reasonably good condition with minor areas of spalled surfaces and deteriorated mortar (Figure 1D-93). Refer to the previous section for detailed discussion of the masonry and coatings. Stone lintels measuring 9 inches deep and stone sills measuring 5 inches deep with 4 inches of bearing at the ends frame the window openings. Some damaged stone sills are found in various locations.

Painted wood shingles are located on the side walls of the dormers (Figures 1D-94 and 1D-95) the porch enclosure on the south wall (Figure 1D-96) and the porch enclosure on the west wall. Painted wood shingles are also found on the dwelling entry located on the north side. The wood shingles are in good condition with some deterioration in lower areas along the roof line. The paint finish is also in good condition with some minor areas of deterioration.

Figure 1D-93 Detail of the painted brick masonry on the south elevation.

Figure 1D-94 Painted wood shingles on the sidewalls of the second floor dormers.

Figure 1D-95 Painted wood shingles on the sidewalls of the second floor dormer.

Figure 1D-96 Painted wood shingles on the South Porch enclosure on the south elevation.

A variety of wood windows are found throughout the Keepers' Dwelling. A small number of windows appear to be original, but most are replacements. Basement windows are top-hinged, inswing units with two lights (Figures 1D-97, 1D-98 and 1D-99). All basement windows measure 2 feet 10 inches wide by 1 foot 7 inches high, except for one window on the west wall that measures 2 feet 6 inches wide by 1 foot 7 inches high. Hardware includes a pair of hinges and a sash lock on the lower end. The windows are in reasonably good condition with some damaged wood and deteriorated glazing putty. The paint finish is in fair condition. Storm windows are mounted on the exterior face. All storm windows are in poor condition with rotted wood and deteriorated paint.

First floor windows are double hung units with two glass lights in both the upper and lower sash, as seen in this bathroom window on the east wall (Figure 1D-100 and 1D-101) which measures 2 feet 6 inches wide by 4 feet 5 inches high. Other double-hung windows on the east part of the dwelling measure 3 feet 0 inches wide by 5 feet 1 inches high. On the south wall in the living room of the east part there is a pair of double hung windows that are replacements and only have a single glass light in the upper and lower sash (Figures 1D-102 and 1D-103). In the west part of the dwelling the wood windows, which measure 2 feet 8 inches wide by 5 feet 1 inches high, are also double-hung units with a single glass light in the upper and lower sash (Figure 1D-104). Most windows are replacements. In a small closet on the north side, there is an inswing wood casement window that measures 1 foot 1 inches wide by 3 feet 0 inches high. There are also some double-hung windows with two lights in the upper and lower sash on the north wall and in the north entry.

Figure 1D-97 Interior view of typical in-swinging, top hinged Basement window.

Figure 1D-98 Basement window and deteriorated storm sash on the north elevation.

Figure 1D-99 Basement window and deteriorated storm sash on the south elevation.

Figure 1D-100 Interior view of first floor Bathroom double hung window on the east elevation.

Figure 1D-101 Exterior view of first floor Bathroom double hung window and storm sash on the east elevation.

Figure 1D-102 Exterior view of first floor Living Room double hung windows and storm sash on the south elevation.

Figure 1D-103 Interior view of first floor Living Room double hung windows on the south elevation.

All second floor windows are double hung wood units, with most windows having two glass lights in both upper and lower sash (Figures 1D-105 and 1D-106). Window sizes vary throughout the dwelling with the most common sizes as 2 feet 8 inches wide by 4 feet 10 inches high on the west part and 2 feet 6 inches wide by 4 feet 5 inches high on the east part. One window on the west wall, measuring 2 feet 8 inches wide by 5 feet 0 inches high, and two windows on the south wall, measuring 2 feet 7 inches wide by 4 feet 9 inches high, are more recent replacement units with a single glass light in both upper and lower sash.

In general, the windows are in fair condition with some areas of deteriorated glazing putty and peeling paint. Most windows also have a storm/screen window on the exterior. The age of these storm/screen windows is not known, however, they are in generally poor condition with rotted wood and peeling paint. Brick mold trim around the exterior face of the window openings has peeling and deteriorated paint and some rotted areas.

Figure 1D-104 First floor double hung window in the west part of the Keepers' Dwelling.

Figure 1D-105 Second floor double hung window.

Figure 1D-106 Second floor double hung window.

There are four exterior doors and three porch doors on the first floor of the Keepers' Dwelling plus the basement door at the small stair enclosure on the north side. Exterior door sizes and types are:

- Southeast entry — 2′-9 ½″ x 6′-9 ½″ x 1 5/8″ wood, 3 panel with one glass light (Figure 1D-107)
- Southeast entry porch — 2′-10″ x 6′-8″ x 1 ¼″ wood storm, 3 panel with one glass light (Figure 1D-108)
- South entry — 2′-9 ½″ x 6′-9 ½″ x 1 5/8″ wood, 3 panel with one glass light (Figure 1D-109) plus wood screen door (Figure 1D-109A)
- North entry — 2′-9 ½″ x 6′-9″ x 1 5/8″ wood, 3 panel with four glass lights (Figures 1D-110 and 1D-111)
- North entry porch — 2′-9 ½″ x 6′-7″ x 1 5/8″ wood, four panel (Figure 1D-112)
- West entry — 2′-10″ x 6′-9 ½″ x 1 5/8″ wood, five panel (Figure 1D-113) with glass sidelights and wood storm door (Figure 1D-114)
- West entry porch — 2′-8″ x 6′-7″ x 1 3/8″ wood, three panel with three glass lights (Figure 1D-115)
- Basement stair — 2′-8″ x 5′10″ x 1 3/8″ wood, two panel with single glass light (Figure 1D-115A)

Figure 1D-107 Wood door at the east first floor Dwelling entry from the southeast porch.

Figure 1D-108 Wood door at the southeast porch.

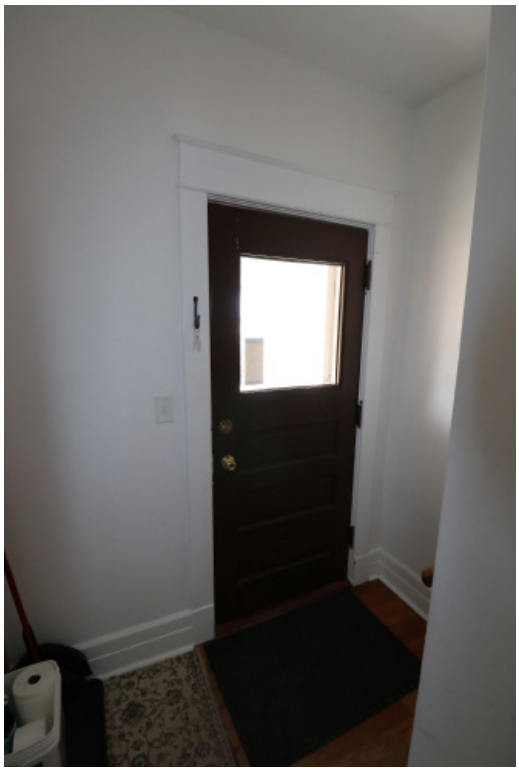

Figure 1D-109 Wood door at the central stair hallway entry from the south porch.

Figure 1D-109A Wood screen door at the south entry.

Figure 1D-110 Wood door at the entry to the Gift Shop from the North Porch.

Figure 1D-111 Wood door at the entry to the Gift Shop from the North Porch.

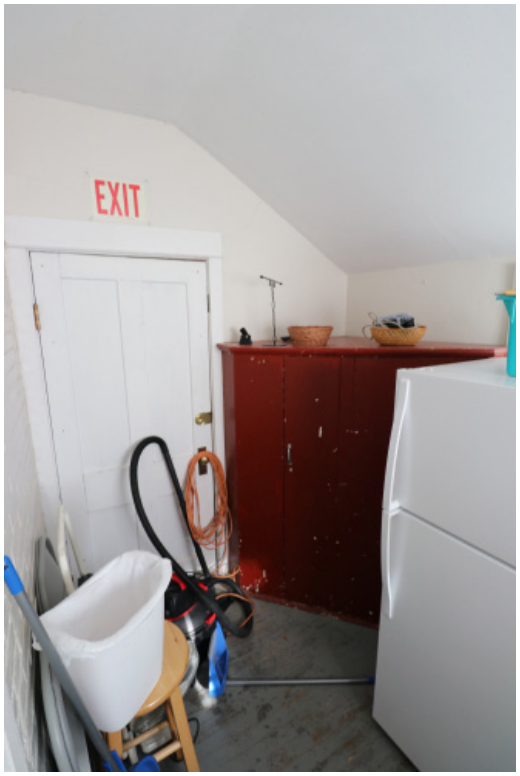

Figure 1D-112 Wood door at the entry to the North Porch.

Figure 1D-113 Wood door at the Gift Shop entry from the West Porch.

Figure 1D-114 Wood storm door at the Gift Shop entry from the West Porch.

Figure 1D-115 Wood door at the entry to the West Porch. This is the public entry.

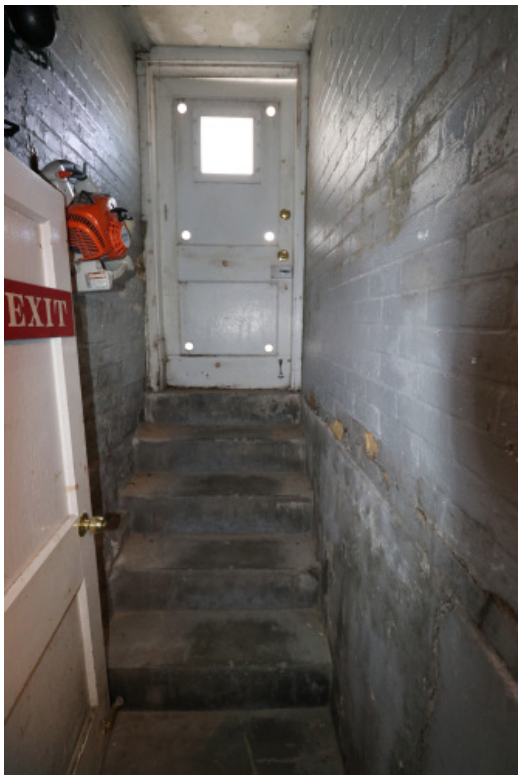

Figure 1D-115A Wood door at the Basement stairwell on the north elevation.

With the exception of the basement stair exit door, which is painted, all exterior doors have a stain and urethane finish and are in generally good condition. Storm and screen doors are painted and are in fair condition. There are a variety of locksets including push-button security locks and keyed locksets and cylinders. All hardware is in good condition.

Interior Conditions and Analysis

The interior of the Keepers' Dwelling has been maintained very well and is fully furnished for the guest keepers and visitors. Interior finishes generally include painted gypsum board and plaster walls and ceilings, painted wood trim, hardwood floors, and interior doors with a stain and urethane finish.

The first floor single bedroom apartment on the east end of the building contains a Living Room (Figures 1D-116 and 1D-116A), Bathroom (Figures 1D-117 and 1D-118), Kitchen (Figures 1D-119 and 1D-120) and Bedroom (Figure 1D-121). A small room, called an Office, is located

off the Kitchen and is kept locked and used for storage. Painted wood bead board wainscot, 4 feet 1 inches high, is located on the north and west wall of the Kitchen. Boards are 3 ¼ inches wide. Wood flooring throughout this part of the dwelling is 3 ½" wide hardwood with a natural finish. All finishes throughout are in good condition.

The single bedroom apartment is entered via the enclosed Porch on the southeast corner. This Porch has a painted concrete floor, painted wood beadboard paneling on the south wall, painted brick on the north and west wall, and painted wood beadboard ceiling (Figures 1D-122 and 1D-123).

Adjacent to the Living Room is a Foyer that contains a narrow hallway (Figures 1D-124 and 1D-125) and the stairways to the Basement (Figures 1D-126 and 1D-127) and to the second floor (Figures 1D-128 and 1D-129). This Foyer is also an entry point from the South Porch. This Foyer was kept locked and use was restricted to the maintenance staff.

Figure 1D-117 Bathroom in the east side apartment on the first floor.

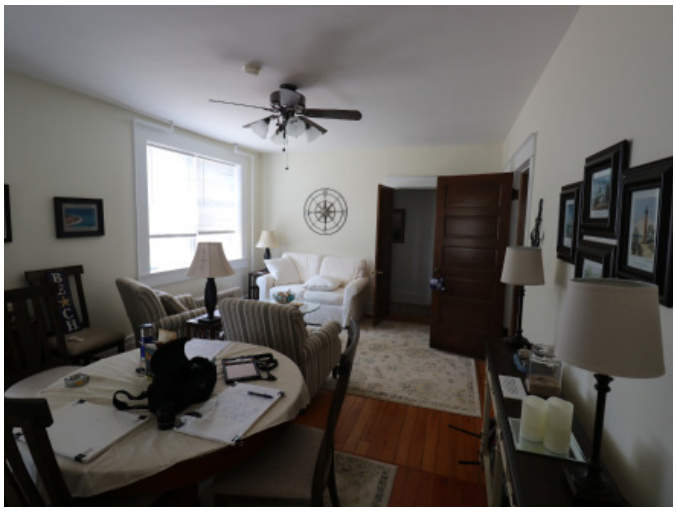

Figure 1D-116 Living Room in the east side apartment on the first floor.

Figure 1D-116A Living Room in the east side apartment on the first floor.

Figure 1D-118 Bathroom in the east side apartment on the first floor.

Figure 1D-119 Kitchen in the east side apartment on the first floor.

Figure 1D-120 Kitchen in the east side apartment on the first floor.

Figure 1D-121 Bedroom in the east side apartment on the first floor.

Figure 1D-122 Porch on the southeast corner leading to the first floor apartment entry.

Figure 1D-123 Southeast porch and entry door into the apartment. Note step up at door.

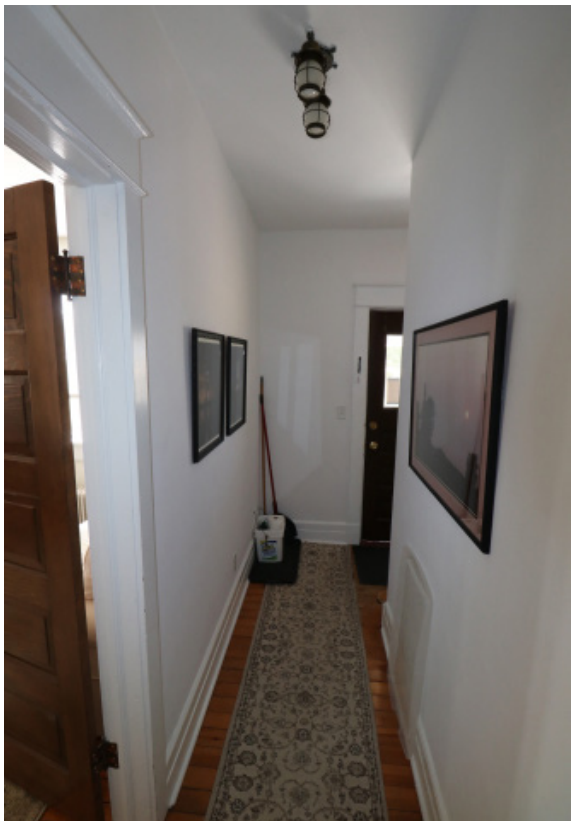

Figure 1D-124 Foyer and stair hallway in the first floor apartment.

Figure 1D-125 Foyer and stair hallway in the first floor apartment.

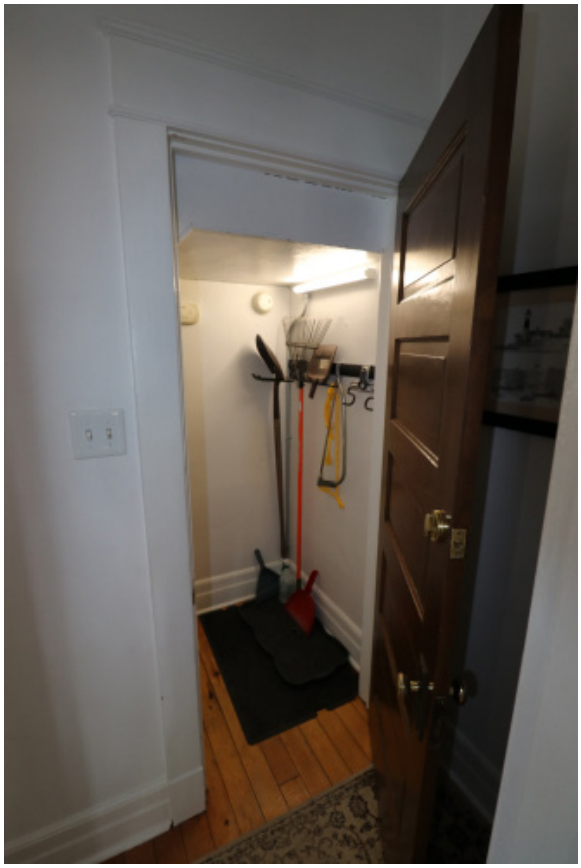

Figure 1D-126 Landing at the top of the stairway leading to the Basement.

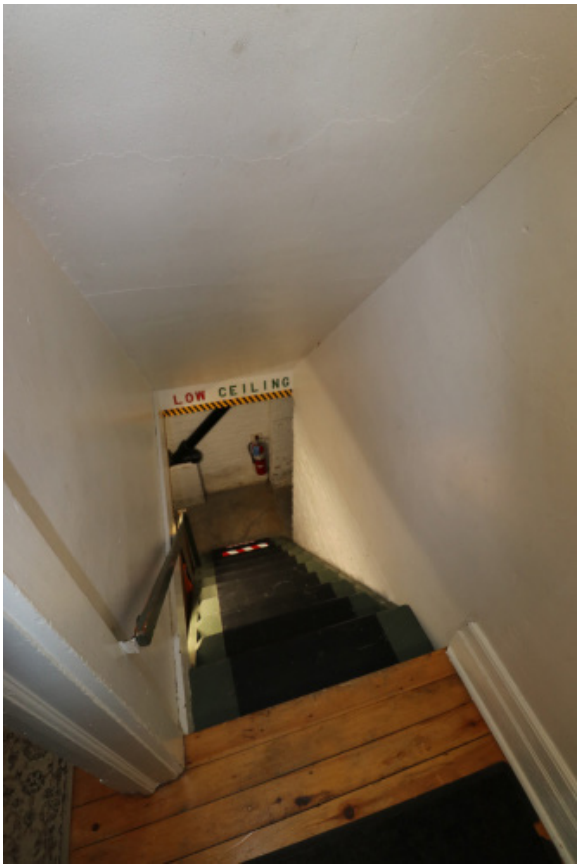

Figure 1D-127 Stairway to the Basement.

Figure 1D-128 Lower section of the stairway leading to the second floor apartment.

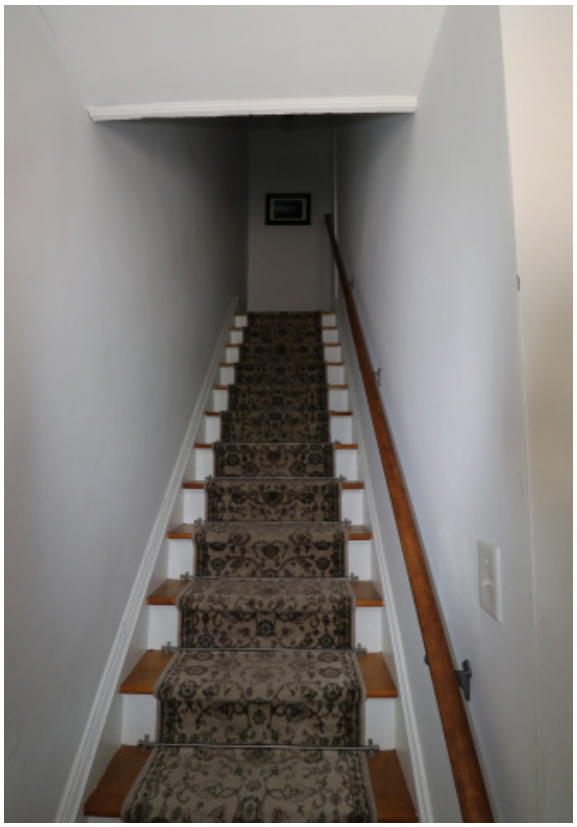

Figure 1D-129 Upper section of the stairway leading to the second floor apartment.

Figure 1D-130 Small landing at the foyer at the west end of the first floor providing entry to the Gift Shop.

The west part of the first floor of the Keepers' Dwelling, originally living quarters, now serves as a Gift Shop and entry point to the Passageway and Light Tower. After passing through the enclosed West Porch, a small landing and stairway (Figures 1D-130 and 1D-131) provides access to the first-floor Gift Shop. The Hallway (Figures 1D-132 and 1D-133) contains an open stairway to the second-floor living quarters and provides entry to the various rooms that are used as the Gift Shop and the Display Room (Figures 1D-134 and 1D-135) which leads to the Passageway and Light Tower.

Figure 1D-131 Small set of steps leading from the landing in the Foyer to the main level of the Gift Shop.

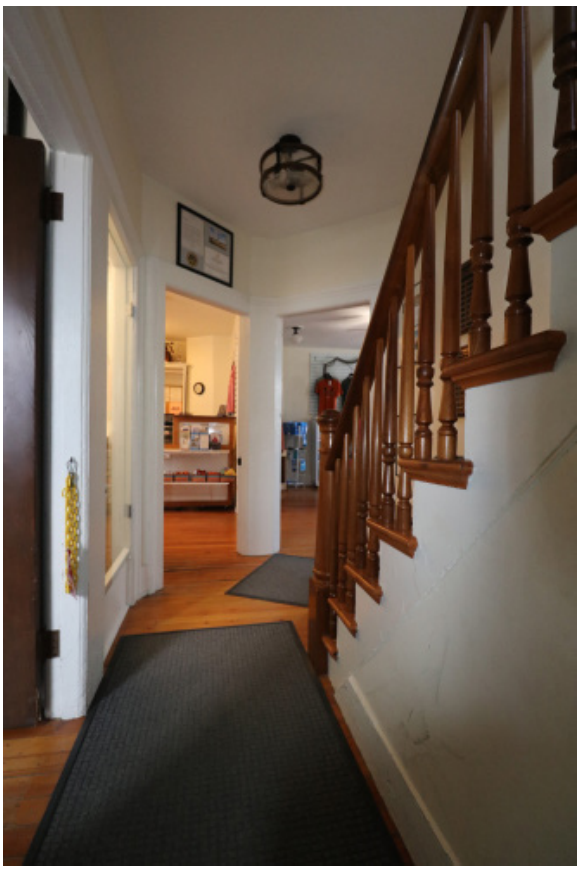

Figure 1D-132 First floor Hallway with open stairway in the west end of the dwelling. This was originally living quarters for the Keeper.

Figure 1D-133 Open stairway leading to the second floor apartment.

Figure 1D-134 Display Room with exhibits.

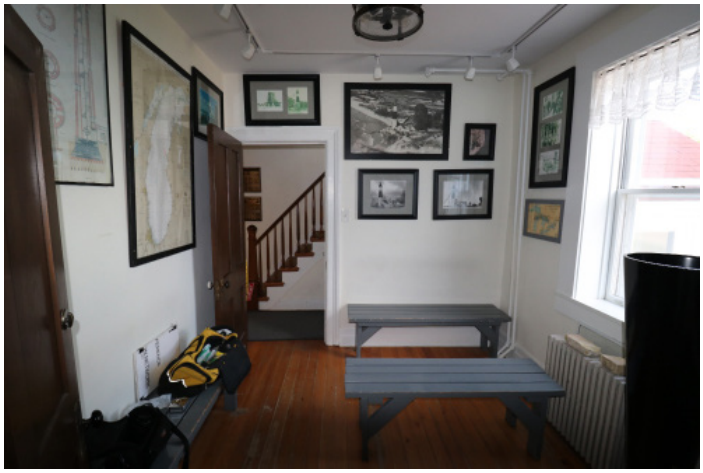

Figure 1D-135 Display Room with exhibits.

A small Closet has been converted to use for displays (Figure 1D-136). The three rooms used for retail sales as a Gift Shop were likely a Bedroom (Figure 1D-137), Living Room (Figures 1D-138 and 1D-139) and Kitchen (Figures 1D-140 and 1D-141), where the retail checkout counter is now located.

Features in the Gift Shop include painted gypsum board walls and ceilings, hardwood floors, painted wood trim and a small section of painted wood wainscot (Figure 1D-142). All components of the open stairway to the second floor (Figures 1D-143 and 1D-144), including treads and risers, newel post, handrail, and balusters are natural finish. All finishes throughout are in good condition.

Figure 1D-136 Former Closet used for exhibits.

Figure 1D-137 Original Bedroom, now used as Gift Shop space.

Figure 1D-138 Original Living Room, now used as Gift Shop space.

Figure 1D-139 Original Living Room, now used as Gift Shop space.

Figure 1D-140 Original Kitchen, now used as Gift Shop space.

Figure 1D-141 Original Kitchen, now used as Gift Shop space.

Figure 1D-142 Wood trim and wainscot detail in Gift Shop.

Figure 1D-143 Lower section of the stairway in the Gift Shop leading to the second floor apartment.

Figure 1D-144 Stairway railing detail on the second floor.

There are two enclosed porches, one on the west side of the building that provides the public entry and one on the north side that is used for storage that lead into the Gift Shop. The West Porch (Figure 1D-145) has a painted wood floor, painted wood paneling on the walls and ceiling, and painted brick on the east wall. There is a single step into the porch and another step from the porch into the building. The North Porch (Figure 1D-146) is used as a storage room and the exit door is blocked. Finishes in this room include a painted wood floor with 2 ½ inches-wide boards, painted wood wainscot, painted gypsum board walls and ceilings, and painted brick wall on the south. There is also a single step up from this porch into the building (Figure 1D-147). There are built-in shelves in this room.

The second floor of the Keepers' Dwelling is a large single living unit with two Bathrooms, two Living Rooms, a Kitchen, and four Bedrooms. It is fully furnished and used by volunteer lighthouse

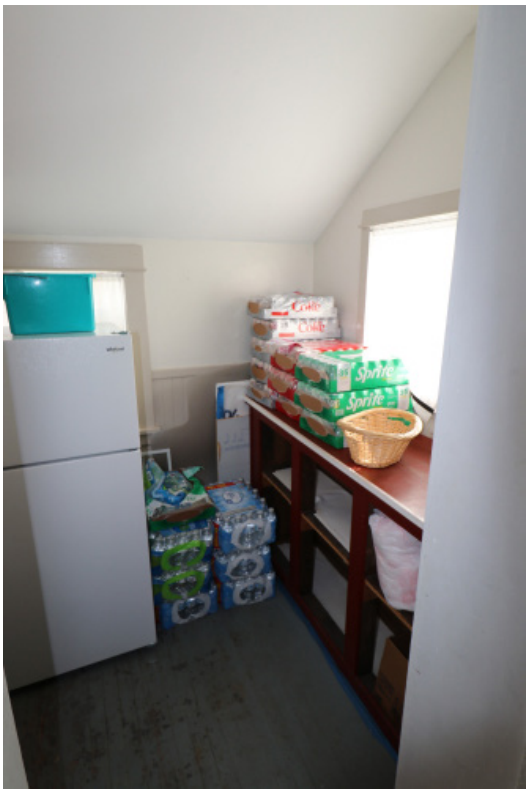

Figure 1D-146 Enclosed Porch on the north elevation, not in use.

Figure 1D-145 Enclosed Porch on the west elevation leading to the Gift Shop entry.

Figure 1D-147 Door opening in the masonry wall between the North Porch and the Gift Shop.

keepers. The previously described stairway from the Gift Shop (Figure 1D-148) and the second centrally located enclosed stairway (Figure 1D-149) provide access to the second floor, which is not open to the public.

On the east part of the second floor there is a Bathroom, Bedroom, Living Room and Kitchen plus various Closets. Bathroom #1 (Figures 1D-150 and 1D-151), Bedroom #1 (Figures 1D-152, 1D-153 and 1D-154) and Living Room #1 (Figures 1D-155 and 1D-155A) are shown in various photographs. A small Hallway (Figure 1D-156) connects these three rooms. The Kitchen (Figures 1D-157 and 1D-158) also serves as the dining area. Built in wood cabinets line the east wall of the Kitchen. A narrow Hallway (Figure 1D-159) that also contains a Pantry (Figure 1D-160), connects the east and west parts of the second floor. Finishes in this east part include 3 ¼ inches-wide hardwood flooring, sheet vinyl flooring in the Kitchen and Bathroom #1, painted gypsum board walls and ceilings, and painted wood trim. All finishes are in very good condition.

Figure 1D-149 Central stair from the second floor apartment.

Figure 1D-148 Stairway and Hallway at the west end of the second floor apartment.

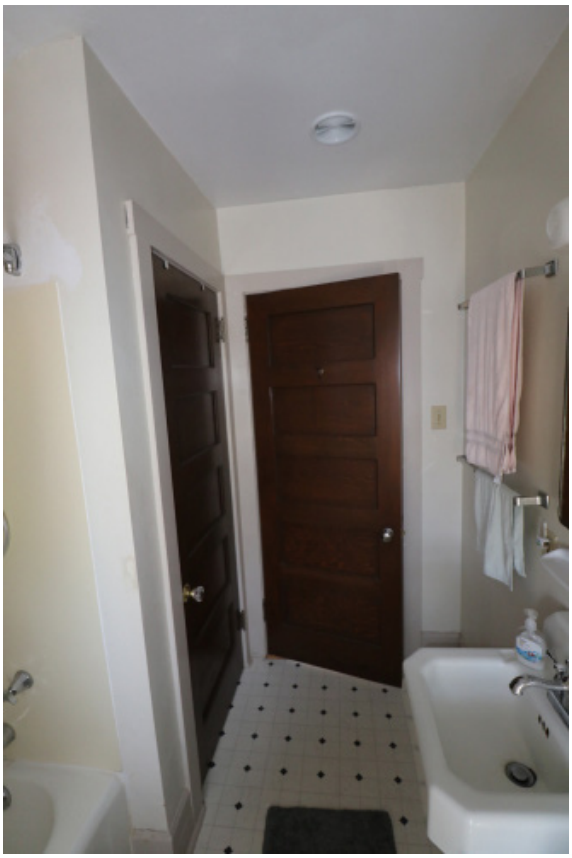

Figure 1D-150 Bathroom #1 in the second floor apartment, east part.

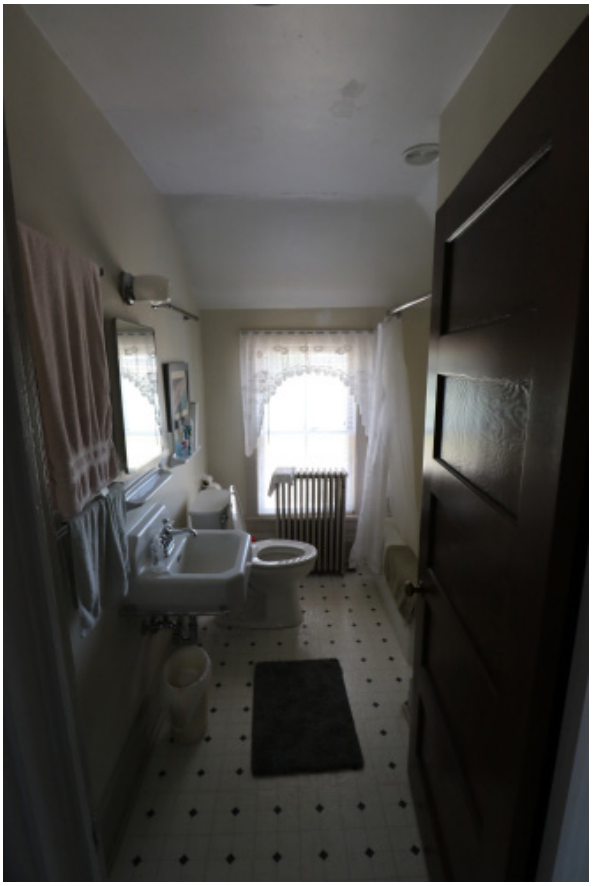

Figure 1D-151 Bathroom #1 in the second floor apartment, east part.

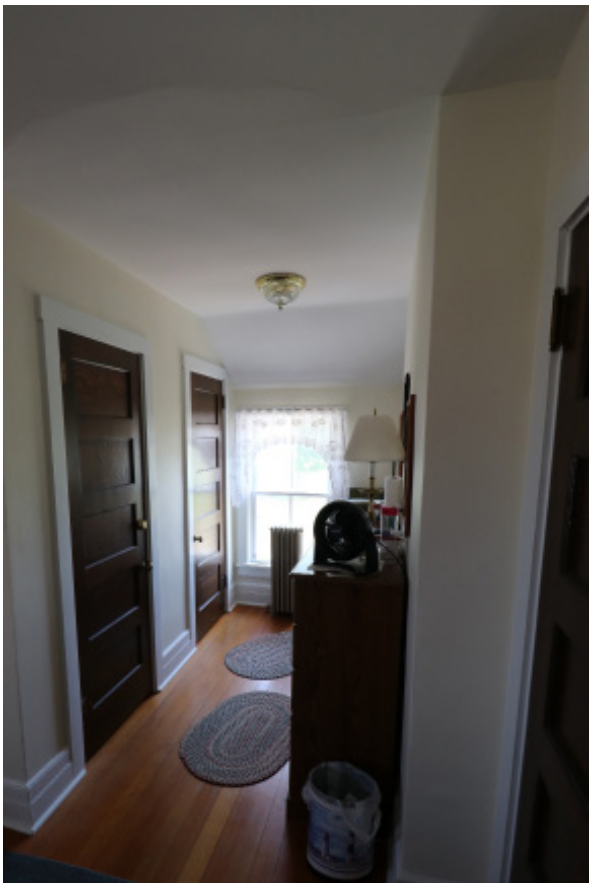

Figure 1D-154 Bedroom #1 in the second floor apartment, east part.

Figure 1D-152 Bedroom #1 in the second floor apartment, east part.

Figure 1D-153 Bedroom #1 in the second floor apartment, east part.

Figure 1D-155 Living Room #1 in the second floor apartment, east part.

Figure 1D-155A Living Room #1 in the second floor apartment, east part.

Figure 1D-156 Hallway in the second floor apartment, east part.

Figure 1D-159 Hallway in the second floor apartment connecting the east and west parts.

Figure 1D-157 Kitchen in the second floor apartment, east part.

Figure 1D-158 Kitchen in the second floor apartment, east part.

Figure 1D-160 Pantry in the connecting Hallway.

The west part of the second floor contains three Bedrooms, one Bathroom, another Living Room, various Closets and a central open Hallway with stair. Bathroom #2 (Figures 1D-161 and 1D-162), Bedroom #2 (Figures 1D-163), Bedroom #3 (Figures 1D-164 and 1D-165) and Bedroom #4 (Figures 1D-166 and 1D-167) are shown in various photographs along with Living Room #2 (Figure 1D-168 and 1D-169). Similar finishes include hardwood floors, painted gypsum board walls and ceilings and painted wood trim are located throughout. Bathroom #2 has ceramic tile floors and walls. All finishes are in very good Condition.

Figure 1D-161 Bathroom #2 in the second floor apartment, west part.

Figure 1D-162 Bathroom #2 in the second floor apartment, west part.

Figure 1D-164 Bedroom #3 in the second floor apartment, west part.

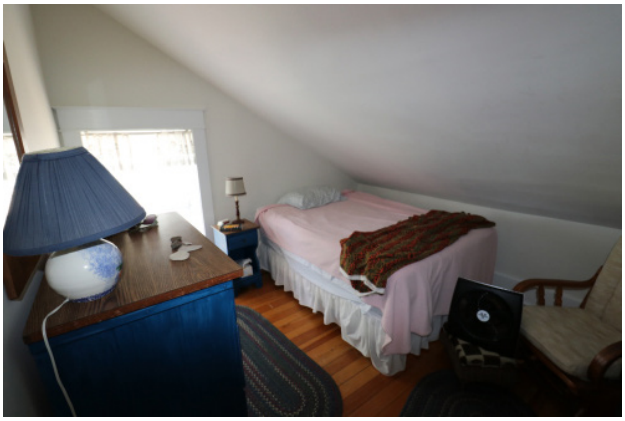

Figure 1D-163 Bedroom #2 in the second floor apartment, west part.

Figure 1D-165 Bedroom #3 in the second floor apartment, west part.

Figure 1D-166 Bedroom #4 in the second floor apartment, west part.

Figure 1D-167 Bedroom #4 in the second floor apartment, west part.

Figure 1D-168 Living Room #2, in the second floor apartment, west part.

Figure 1D-169 Living Room #2, in the second floor apartment, west part.

Figure 1D-170 Interior wood door between the Kitchen and Living Room in the first floor apartment.

There are a variety of styles of interior wood doors throughout the Keepers' Dwelling, including some new doors. All doors have a natural stained finish and are in generally good condition. An interior five panel door (Figure 1D-170) is located between the Living Room and Kitchen on the first floor. This door measures 2 feet 8 inches wide by 6 feet 9 inches high by 1 ¼ inches thick. All interior doors on the first floor in the east part of the dwelling are of similar style but of various sizes.

A relatively new four-panel wood door (Figure 1D-171) is located in the Closet that is off the Gift Shop checkout room. This door measures 2 feet 9 inches wide by 6 feet 9 inches high by 1 ¼ inches thick. Similar style doors of various sizes are located throughout this west part of the dwelling.

A variety of interior wood door styles are found on the second floor including a five panel door and a painted wood bi-fold door (Figure 1D-172), a two panel door, and two triangular topped closet doors (Figure 1D-173). Three of these door styles are located in Living Room #1 (Figure 1D-174). The triangle top door at the Closet above the stairway measures 2 feet 5 inches wide by 4 feet 8 inches high by 1 ¼ inches thick. A four-panel door at Bedroom #3 and the Bedroom Closet door (Figure 1D-175) is shown in the photograph.

There is a wide variety of interior door hardware including latch sets with glass, metal and porcelain knobs and keyed cylinder locks that provide security on bedroom and closet doors for the volunteer keepers.

Figure 1D-171 Newer interior wood panel door in a Closet off of the first floor Gift Shop (former Kitchen).

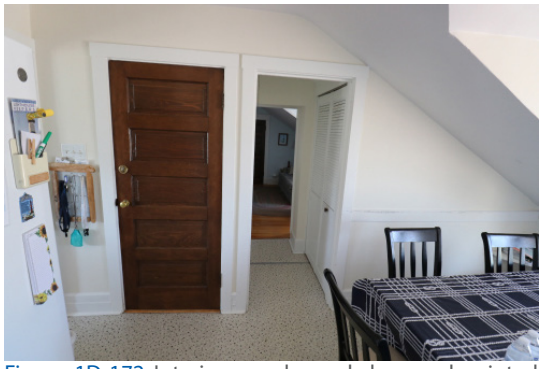

Figure 1D-172 Interior wood panel door and painted wood louver Pantry door in the second floor Hallway.

Figure 1D-173 Triangular topped interior wood door in a Closet off of Living Room #1.

Figure 1D-174 Various interior wood doors in Living Room #1.

Figure 1D-176 West part of the Basement and access stair from west Foyer.

Figure 1D-177 Central stair from the first floor to the east part of the Basement.

Figure 1D-175 Interior wood doors in Bedroom #3 and a Closet off of Bedroom #3.

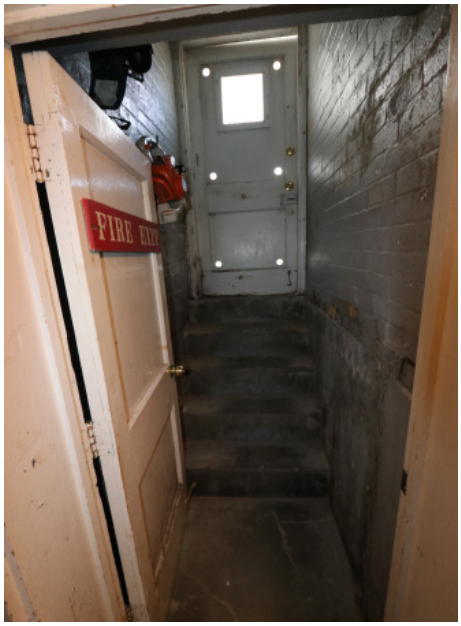

Figure 1D-178 Concrete stair from the Basement to the exterior on the north elevation.

The Basement of the Keepers' Dwelling is a semi-finished utility space that is used for general storage, Gift Shop storage, and mechanical, electrical and plumbing services. The east and west parts are connected. There are three stairs that provide access to the Basement including a west stair (Figure 1D-176), a central stair (Figure 1D-177) and an enclosed concrete stair on the north side that provides egress to the exterior (Figure 1D-178).

At the east end of the Basement there are two mechanical equipment rooms. One room contains two boilers, two heat exchangers and related zone controls (Figure 1D-179). The adjacent mechanical room contains the water well pressure tank and is also used for storage. The main room in the east part is used as a Workshop (Figures 1D-180 and 1D-181) and contains electrical sub-panels, a utility sink, a washer and dryer, and a sump pump. On the

Figure 1D-179 Mechanical Room in the east part of the Basement.

Figure 1D-180 Workshop and general storage space in the east part of the Basement.

north side of the east part, there is a Storage Room (Figures 1D-182 and 1D-183) and a Security Room (Figure 1D-184) that contains security camera monitors and other security equipment. The north masonry wall of the Storage Room is reinforced with a 5-feet-high concrete wall poured against the masonry.

Figure 1D-181 Workshop and general storage space in the east part of the Basement.

Figure 1D-182 Storage Room in the east part of the Basement.

Figure 1D-183 Storage Room in the east part of the Basement.

Figure 1D-184 Security Room, with security equipment and monitors, in the east part of the Basement.

Figure 1D-185 Storage Room for Gift Shop inventory in the west part of the Basement, south side.

There is low headroom clearance of approximately 6 feet 4 inches from the concrete floor to the plaster ceiling in the east part of the Basement. Surface-mounted water piping, heating piping, and electrical conduit further reduces this headroom. Finishes include painted brick and stone walls, concrete floors and plaster ceiling. Sections of plaster ceiling have been removed for routing of mechanical and electrical services. All finishes are in very poor condition.

The west part of the Basement is similar with a large Storage Room on the south side that is used primarily for Gift Shop merchandise storage (Figures 1D-185 and 1D-186) and a general Storage Room on the north side (Figures 1D-187 and 1D-188). There is an 11-inches deep pit measuring 4 feet 4 inches by 4 feet 6 inches in the floor at the base of the west wall (Figure 1D-189). This pit contains an abandoned water well pipe and other stored material. There is also a smaller Storage Room constructed of concrete masonry units (Figure 1D-190).

Figure 1D-186 Storage Room for Gift Shop inventory in the west part of the Basement, south side.

Figure 1D-187 General Storage Room in the west part of the Basment, north side.

Figure 1D-188 General Storage Room in the west part of the Basment, north side.

Figure 1D-189 Eleven inches deep pit in the General Storage Room along the est wall.

Figure 1D-190 Storage Room constructed of concrete masonry unit walls.

In the west part of the Basement there is even lower headroom clearance of approximately 5 feet 10 inches to 6 feet 0 inches from the concrete floor to the plaster ceiling. Surface mounted water piping, heating piping, and electrical conduit further reduces this headroom. Finishes include painted brick and stone walls, concrete floors, and plaster ceiling. The concrete floor is in very poor condition with numerous cracks and heaved sections (Figures 1D-191 and 1D-192). Sections of plaster ceiling have been removed for routing of mechanical and electrical services. All finishes are in very poor condition.

There are six wood two-panel doors with a paint finish in the Basement. Additional doors have been removed and are stored in the southeast Storage Room. A typical door located in the common masonry wall between the east and west parts (Figure 1D-193) measures 2 feet 6 inches wide by 5 feet 11 inches high by 1 3/8 inches thick. The wood two-panel door that is located at the north exit stair (Figure 1D-194) measures 2 feet 6 inches by 5 feet 8 ½ inches by 2 inches thick. This door is marked with a sign stating "Fire Exit". All wood doors are in fair condition, however, the paint finish is in poor condition.

Figure 1D-193 Painted wood door in the Basement through the wall connecting the east and west parts.

Figure 1D-191 Concrete floor slab cracking in the west part of the Basement.

Figure 1D-192 Concrete floor slab cracking in the west part of the Basement.

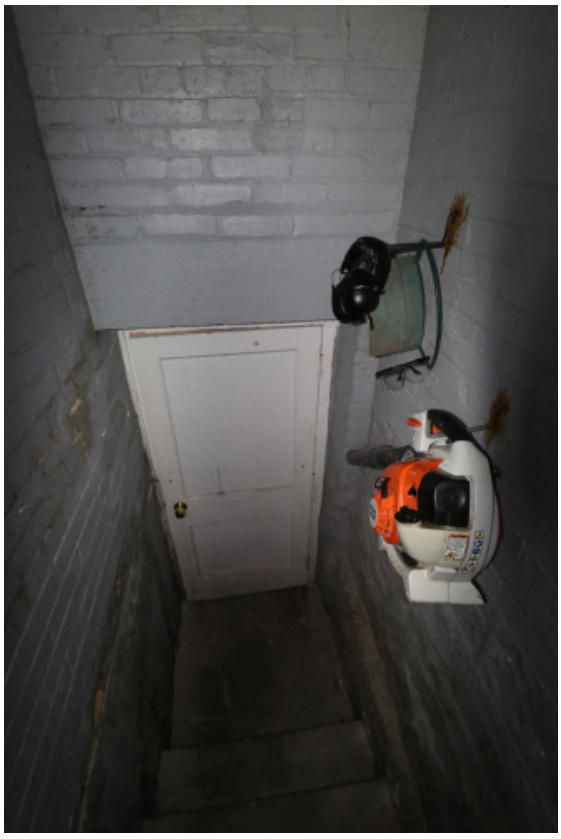

Figure 1D-194 Painted wood door at the entry to the north elevation exit stair.

MECHANICAL AND ELECTRICAL SYSTEMS CONDITIONS AND ANALYSIS

The plumbing system in the Keepers' Dwelling serves the multiple Kitchens, Bathrooms, exterior hose bibs and other fixtures. A water well (Figure 1D-195) is located off the northeast corner of the building. The depth and age of the water well is not known. The water service line enters the east end of the Basement where the expansion tank is located (Figure 1D-196). Although most water lines are copper, a few sections of galvanized iron pipe remain. Most of the copper water lines are located below the plaster ceiling in the Basement (Figure 1D-197). The type of pipe where concealed within the walls above is not known. Where visible, the copper piping was in good condition.

Figure 1D-195 Water well located off the northeast corner of the Keepers' Dwelling.

Figure 1D-196 Water well pressure tank located in the Basement.

Figure 1D-197 Exposed copper water lines in the Basement.

Sanitary pipe in the Basement is cast iron (Figures 1D-198 and 1D-199). The sanitary pipe exits the southeast corner of the Basement through the south wall. The drain field is located south of the access road and the southernmost bollard. The size, and age of the septic tank and drain field is not currently known.

There are two sump pumps located in the Basement. One is located near the southeast corner (Figure 1D-200) and one on the north side (Figure 1D-201). The Basement was dry with no standing water.

Figure 1D-198 Cast iron sanitary piping in the Basement.

Figure 1D-199 Cast iron sanitary piping exiting the southeast corner of the Basement.

Figure 1D-200 Basement sump pump located near the southeast corner.

Figure 1D-201 Basement sump pump centrally located on the north wall.

The heating system in the Keepers' Dwelling consists of two propane fired boilers (Figure 1D-202) which provide hot water for the heating system and hot water for two indirect-fired hot water heaters (Figures 1D-203 and 1D-204) for the domestic hot water. The boilers are both Weil-McLain 167,000 btuh, Model CGS 6 PIL, Series #1 units (Figure 1D-205). These boilers and tanks, ages unknown, are located in a mechanical room on the east side of the Basement. Zone control valves (Figure 1D-206) and a control panel (Figure 1D-207) are also located in this room. Cast iron radiators (Figure 1D-208) are located throughout the Keepers' Dwelling and are seen in many previous photographs. The heating system is controlled with digital thermostats (Figure 1D-209) located in various rooms. There is no air conditioning. There were no reported problems with the heating system.

Figure 1D-202 Propane fired boilers for building heat and domestic hot water located in the Basement Mechanical Room.

Figure 1D-203 Indirect fired hot water heaters for domestic hot water located in the Basement Mechanical Room.

Figure 1D-204 Indirect fired hot water heaters for domestic hot water located in the Basement Mechanical Room.

Figure 1D-205 Weil-McLain 167,000 btuh propane gas fired boiler.

Figure 1D-206 Heating system zone control valves in the Basement Mechanical Room.

Figure 1D-207 Boiler control unit in the Basement Mechanical Room.

Figure 1D-208 Typical cast iron radiator. This one is located in the Gift Shop (former Kitchen).

Figure 1D-209 Typical heating system thermostat control unit.

The electrical system in the Keepers' Dwelling includes multiple sub-panels in the Basement (Figures 1D-210, 1D-211 and 1D-212) and one in the east part of the second floor. A variety of styles and types of light fixtures are found throughout the dwelling (Figures 1D-213, 1D-214, 1D-215, 1D-216, 1D-217 and 1D-218) along with switches and receptacles. Two exterior pole-mounted lights (Figure 1D-219) are located near the dwelling. There were no reported problems with the electrical system.

Figure 1D-210 Electric sub-panel located in the Basement.

Figure 1D-211 Electric sub-panel located in the Basement.

Figure 1D-212 Electric sub-panel located in the Basement.

Figure 1D-213 Interior light fixture with fan.

Figure 1D-215 Interior light fixture example.

Figure 1D-216 Interior light fixture example.

Figure 1D-217 Interior light fixture example.

Figure 1D-214 Interior light fixture example.

Figure 1D-218 Interior light fixture example.

Figure 1D-219 Exterior pole mounted light fixture.

LIFE SAFETY SYSTEMS CONDITIONS AND ANALYSIS

There are no central alarm systems in the Keepers' Dwelling. Local smoke detectors (Photo 1D-220) are provided in Bedrooms and other rooms throughout. It is not known if these detectors are hard-wired or battery-operated. A single fire extinguisher (Figure 1D-221) is located in the central Hallway on the second floor.

Figure 1D-220 Smoke detector/smoke alarm.

Figure 1D-221 Fire extinguisher.

PASSAGEWAY

General

The Passageway is the small, approximately 8 feet 0 inches wide by 14 feet 4 inches long, single-story link that connects the first floor of the Keepers' Dwelling to the Light Tower. The Passageway continues in use today as the Light Tower access point for staff, volunteers, and visitors. It contains some built-in cabinets, electrical panels, electronic equipment, and other displays.

STRUCTURAL SYSTEM AND ANALYSIS

The Passageway between the Keepers' Dwelling and the Light Tower is accessible from the interior of both structures. Stairs and a doorway at the west facade of the Passageway provide access from the exterior. The stair rails are a 1-3/4-inch outside diameter metal pipe and are anchored to the sidewalk at the bottom. The top of the rail is embedded into the brick masonry of the building on the north side, and to the side of the steps at the south side. The rails are loose and can be moved with little force, likely related to the size of the rail relative to its span between anchorage locations (Figure 1D-222). Similar distress is noted in the steps and exterior masonry as observed at the Keepers' Dwelling.

Figure 1D-222 Steps to west door of connector link; note top anchorage for rail differs each side of steps, north side is anchored to building wall and south side is anchored to steps.

Cracking is present in the masonry originating at each end of the stone masonry lintel over the west door on both the exterior and interior of the wall (Figure 1D-223). On the exterior, this lintel is not aligned within the plane of the wall, assuming the stone is of uniform width along its length. The stone projects outward at the south bearing and is set inward at its north bearing. Cracking is also present at both the exterior and interior where the Passageway meets the Light Tower (Figures 1D-224, 1D-225 and 1D-226). The crack in the northeast corner was measured to be 5mm in width but visually increases in width toward the top of the wall. Sand is accumulated on the exterior sill of the east window (Figure 1D-227).

Figure 1D-223 No visible displacement of connector link roof structure, misalignment and cracking present on either side of stone masonry header.

Figure 1D-224 Cracking present at north end of east wall at intersection of tower.

Figure 1D-225 Cracking present at north end of west wall at intersection of tower.

Figure 1D-226 Cracking present at north end of east wall at intersection of tower on interior.

Figure 1D-227 Sand accumulation on sill of east window.

No displacement is visible in the ridge line or field of the gable roof. The paver floor is displaced downward compared to the thresholds at the doorways (Figure 1D-228). Considering natural grade elevation, the pavers were likely placed atop fill materials to create the raised floor elevation.

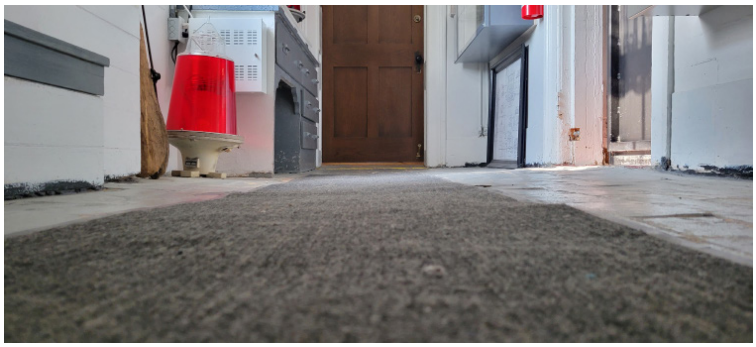

Figure 1D-228 Vertical displacement of paver floor.

Discussion

The cracking at the intersection with the tower is anticipated due to the differential movements between the tall, slender tower and the short, squat connector link. The cracking on either side of the stone header over the western door is likely due to the rate of thermal movement of the large stone header relative to the smaller brick masonry units. These joints are recommended to be designed to allow for this differential movement to occur.

Figure 1D-229 Asphalt shingle roof on the Passageway.

The drop in the paver floor on the interior could be related to the heavy use of the floor or the sand below the pavers has displaced slightly. Continue to monitor the floor for additional displacement, alternatively address for a potentially tripping hazard by resetting the pavers.

Coordinate the repairs to the masonry and steps with those planned for the Keepers' Dwelling.

Figure 1D-230 Metal step flashing at the intersection of the asphalt shingle roof with the metal walls of the Light Tower.

EXTERIOR CONDITIONS AND ANALYSIS

Exterior materials on the Passageway include a "red" asphalt shingle roof and painted brick masonry walls. The asphalt shingle roof (Figure 1D-229) is in reasonably good condition, with wood snow guards (constructed to replicate the historic Yankee gutters) and ridge boards. This section of roof may also have previously

had a built-in gutter that is now covered over. Downspouts are not active. The roof abuts the metal casing of the Light Tower and appears to be appropriately flashed with metal step flashing (Figure 1D-230).

The exterior brick masonry is painted "white" and is in reasonably good condition with some minor areas of spalled brick and peeling paint similar to the Keepers' Dwelling. The numerals "1867" are cut in the stone lintel above the door on the west wall (Figures 1D-229 and 1D-234). The east wall of the Passageway (Figure 1D-231) contains a single wood window. This window is a "cottage style" double-hung unit with two glass lights in the upper sash and four glass lights in the lower sash (Figure 1D-232). The window is 2 feet 0 inches wide by 3 feet 10 inches high and has an exterior wood storm window which is in fair condition. The sashes are in good condition.

Figure 1D-231 East wall of the Passageway with single window.

Figure 1D-232 Interior of Passageway double hung window.

A 2 feet 8 inches wide by 6 feet 8 inches high by ¼ inches thick steel plate exterior door is located on the west wall (Figures 1D-233 and 1D-234). This steel door is in good condition, however, the paint finish is in poor condition. Hardware remnants indicate that there was an in-swinging door at this location (Figure 1D-235) but it is no longer present. Door hardware on the steel plate door includes hinges and a padlock hasp. A set of 3 feet 2 inches wide concrete steps with a metal handrail on each side provide access from the interior to grade at this door. The concrete steps are painted and there is some spalled concrete and peeling paint.

Figure 1D-233 Steel plate door on the west wall of the Passageway.

Figure 1D-234 Steel plate door on the west wall of the Passageway.

Figure 1D-235 Interior view of the steel plate door and hardware remnants.

Figure 1D-236 Interior of Passageway looking north toward the Light Tower.

Figure 1D-237 Interior view of Passageway from within the Light Tower walls.

Figure 1D-238 Interior view of Passageway looking towards the circular stair of the Light Tower.

INTERIOR CONDITIONS AND ANALYSIS

The interior of the Passageway is only 5 feet 11 inches wide (Figure 1D-236) and this narrows down to 3 feet 6 inches wide where it passes through the thick masonry walls of the base of the Light Tower (Figures 1D-237 and 1D-238). Finishes include plaster walls and ceilings with a paint finish, and painted brick and concrete floors. The flat plaster ceiling in the main area of the Passageway is 8 feet 4 ½ inches above the floor. Passing through the base of the Light Tower the ceiling is arched. Floor brick size is 3 ½ inches by 8 inches. Wall and ceiling paint finishes are in good condition. The paint on the floor is peeling and worn.

MECHANICAL AND ELECTRICAL SYSTEMS CONDITIONS AND ANALYSIS

The main electrical service to the building is located on the west wall of the passageway. Underground electrical service from a transformer (Figure 1D-239), located off the southwest corner of the dwelling, is brought to two electric meters mounted on the exterior of the west wall (Figure 1D-240). Electric service is noted as 240 volt, 3 phase. The main 100 amp breaker panel, along with other sub-panels and emergency generator panels, are located on the inner west wall, (Figures 1D-241 and 1D-242). A "Generac" 2.4 kw propane fired emergency generator is located near the northeast corner of the Keepers' Dwelling (Figure 1D-243). Two ceiling mounted industrial style light fixtures are located in the Passageway along with receptacles and switches.

Figure 1D-239 Electric transformer located off the southwest corner of the Keepers' Dwelling.

Figure 1D-240 Electric meters on the exterior of the west wall of the Passageway.

Figure 1D-241 Main electric panel and sub-panels on the west wall of the Passageway.

Figure 1D-242 Main 100 Amp electric panel.

Figure 1D-243 Emergency electric generator located near the northeast corner of the Keepers' Dwelling.

LIFE SAFETY SYSTEMS CONDITIONS AND ANALYSIS

There are no life safety systems in the Passageway.

LIGHT TOWER

General

The Light Tower at the Big Sable Point Light Station is an impressive structure over 100 feet tall (Figures 1D-244, 1D-245 and 1D-246). The exterior metal cladding and "black" and "white" paint scheme add to its uniqueness. The tower is open to the public during designated times allowing visitors to experience the climb of over one hundred steps and the extraordinary views of Lake Michigan and the coastal dunes from the top.

Figure 1D-244 North/northeast elevation of the Light Tower.

Figure 1D-245 West elevation of the Light Tower.

Figure 1D-246 South elevation of the Light Tower.

Structural System and Analysis

The most prominent structure on the site, the black and white alternating color scheme of the light tower helps to delineate the levels, or "coursing," of the steel encasement added to the exterior of the brick masonry tower early in the lifespan of the structure. Reportedly, the Milwaukee Cream City brick used to construct the tower was quickly determined to be inadequate for the severe exposure the tower encounters. In 1900, riveted steel plate and angle sections were bolted together and the void between the brick and plates was filled with a cementitious fill. Shortly thereafter, the upper "ring" of steel was added to extend to the underside of the lantern balcony.

Interior

Window wells in the tower are of greater width at the lower levels of the tower than the upper levels, measuring nearly 6 feet wide at the base of the tower and 2 1/2 feet wide at the Watch Room level. The interior walls of the tower maintain an approximate 8-foot diameter circle, indicating that the exterior brick surface tapers along the vertical axis. An air void is suspected to occur between the interior and exterior wythes based on drawings and known construction of similar towers along the Great Lakes. Plaster finish is applied directly to the interior face of the brick masonry walls. The plaster is cracked in multiple locations with widths measuring up to1/16" (2mm) wide. Predominant patterns of cracking are present at stair treads and between stair landing levels, although crazed cracking is occurring throughout (Figures 1D-247, 1D-248 and 1D-249).

Figure 1D-247 Cracking in plaster at stair tread.

Figure 1D-248 Cracking in plaster at stair tread.

Figure 1D-249 Plaster distress below stairs; note bolt between treads does not extend down through assembly.

At the Watch Room level, the original window opening was downsized to a smaller circular portal-type window when the steel cladding was retrofitted. The interior facing side of the cladding is visible at these portal windows. The steel plate is located directly against the brick masonry; there is no cementitious fill between the plate and the brick masonry. There is corrosion staining on the interior (Figures 1D-250 and 1D-251), and isolated areas where the steel plate and rivet heads have experienced section loss (Figure 1D-252).

Figure 1D-250 Corrosion staining at window well at watch room floor level; note steel is tight to the brick masonry (no cementitious fill between the masonry and the steel plate this level).

The exposed structure in the two-story Lantern Room is painted, and no visible distress is present (Figure 1D-253 and 1D-254). The structure is similar to that observed at Fort Gratiot Light Station and other masonry towers in the region constructed within the same time period. The upper floor of the Lantern Room is 1-1/4-inch-thick plate with 2-inch tall, dropped ends. Eight segments (two of the total 10 segments to create the circle are removed for the ladder access to this floor level) extend 19 inches into the lantern space and project outward of the exterior masonry wall of the lantern approximately 6 inches.

Figure 1D-251 Corrosion of steel plate below port hole window at watch room floor level.

Figure 1D-252 Corrosion staining at window well at watch room floor level; note section loss of rivet heads on the right side of the photo.

Figure 1D-253 Upper walkway of lantern room floor.

Figure 1D-254 Roof structure exposed in lantern room.

Figure 1D-255 Spiral stair riser detail providing the turned down edge of the tread.

Figure 1D-256 Top view of latticed stair tread.

Stairs

Each tread and landing segment is stacked above the previous at the 3 5/8-inch diameter central mast to create the spiral stairs (Figure 1D-255). The stair system is constructed of latticed cast iron surfaces with solid turned-down edges for connections to adjacent sections (Figure 1D-256). The ½-inch thick lattice is cast in a pattern of adjacent football shapes linked together with circular shapes centered on the apex of the long edge of the football shape. The mast is supported on a 10-inch square plate embedded in an approximate 2-foot square stone or concrete foundation visible at the first-floor level. The curved metal rail is 1-1/2 inch outside diameter and is anchored into the wall at least every 55 inches. There are four landings between the first-floor elevation and the Watch Room floor. A curved ship's ladder then extends up from the Watch Room to the Lantern levels. Both the Watch Room and Lantern floor structures are of solid iron segments with turned-down edges similar to the latticed spiral stair landings below.

Pitting of the cast iron is visible through multiple layers of coating on the treads and landings (Figure 1D-257). The lattice in three treads and three landing segments are cracked through; at least two landing segments have been strengthened at these cracked areas with a small metal angle below the lattice and screwed to the turned-down edge of the cast iron piece (Figures 1D-258, 1D-259 and 1D-260). Casting defects were common along the edges of the latticework in the treads and landing segments (Figure 1D-261). Separation between the tread and the interior wall is common throughout. Some of these joints have been sealed and coated, and the sealant has adhesively failed in many locations (Figure 1D-262).

Figure 1D-257 Pitting of and potential cracking through the coated cast iron lattice stair tread.

Figure 1D-258 Underside of lowest landing level (only two sections of the full circle, not a semi-circle like the other landings), note the left section is reinforced with a small metal angle at mid-length.

Figure 1D-259 Cracking at bolt location and added angle section connection in turned down edge of landing section members.

Figure 1D-260 Top surface of the same landing in Figure 1D-257, note reinforcing angle and cracking visible on top surface in lattice and turned down edge adjacent to other landing section.

Figure 1D-261 Casting defect along edge of lattice work in tread.

Figure 1D-262 Adhesive failure of sealant applied at wide edge of tread along interior wall.

Exterior

Although little of the original stone masonry is exposed, the primary grid cracking pattern in the coating on the exterior surface of the tower at grade correlates with stone masonry construction (Figure 1D-263).

The brick of the tower is coated above the Lantern level exterior balcony (Figure 1D-264). The brick is coated and is in similar condition to that observed at the Keepers' Dwelling. From the interior, at one window opening in the masonry, the buff-colored brick was minimally visible through a gap in the wall finish treatments.

Figure 1D-263 Cracking in grid pattern through coating at base of tower; likely reflecting mortar joints of stone foundation.

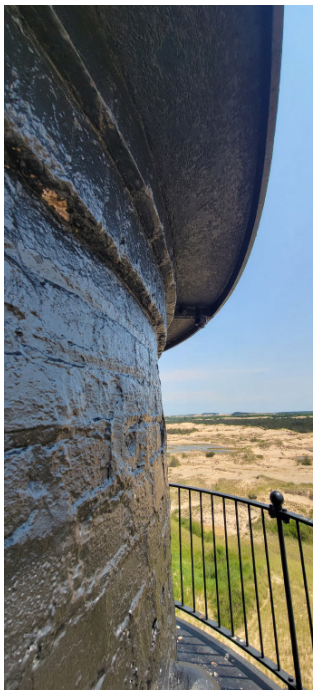

Figure 1D-264 Coated brick on exterior of tower above lantern floor balcony.

The exterior steel plating is comprised of steel plates secured to each other with riveted steel angles on all sides of the plates (Figure 1D-265). The plates, per construction drawings, decrease in thickness and step inward, every two courses, following the exterior taper of the masonry tower, as the installed elevation of the plates increases. The vertical edges of the plates are staggered between courses creating an enlarged "running bond pattern" in the cladding. The rivets were measured, where exposed at an interior window well, to be 1-1/4-inch diameter and spaced at 4-inches on center.

Figure 1D-265 General condition of east portion of tower metal cladding, note staggered alignment of vertical edges of plates creating an enlarged "running bond pattern" of the cladding.

The painted steel cladding is generally in good condition with isolated areas of peeling coating, surface corrosion, and corrosion bi-product accumulating between members causing the members to deform (rust jacking) (Figure 1D-266, 1D-267 and 1D-268). The upper portion of the steel encasement was constructed with larger sections than the lower portions (Figure 1D-269). Corrosion and potential displacement is present at the top surface of the upper cladding at many of the brackets located below the Lantern floor balcony (Figure 1D-270). The horizontal angles at the lower and upper cladding portions do not align (Figures 1D-271, 1D-272 and 1D-273), and thus the bolted

Figure 1D-266 Isolated areas of missing or peeling coating from metal cladding.

connections are not present or are weakened due to their placement within the section of the perimeter angles. Physical connection was not verified but is assumed to be present as there is no visible distress relating to these missing fasteners.

Figure 1D-267 Closer view of corrosion of metal cladding where coating is missing.

Figure 1D-268 Vertical angles deformed at ends likely due to "rust jacking" forces separating the angle sections.

Figure 1D-269 Differences in detailing of metal cladding at top of tower to typical sections below.

Figure 1D-270 Corrosion and potential displacement present at lantern balcony bracket locations at top of upper level metal cladding.

Figure 1D-271 Fastener misalignment in horizontal leg where upper cladding meets lower cladding around perimeter of tower.

Figure 1D-272 Daylight observed through fastener holes in horizontal leg of angles where upper cladding meets lower cladding around perimeter of tower.

Figure 1D-273 Fastener misalignment in horizontal leg where upper cladding meets lower cladding around perimeter of tower.

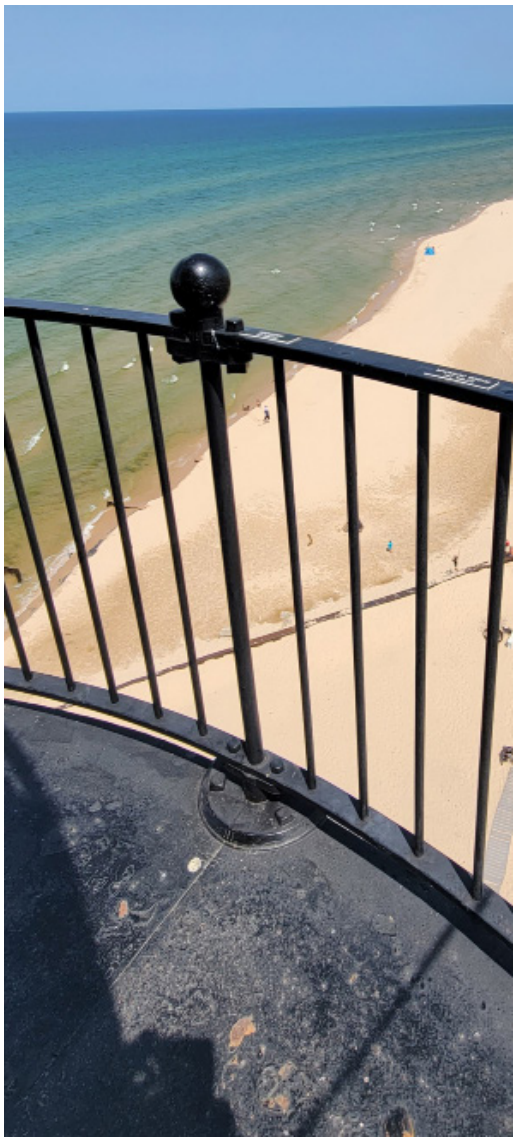

Figure 1D-274 Exterior metal railing at the Watch Deck level.

At the Lantern level, the rail along the perimeter of the exterior balcony is secure when pushed against (Figure 1D-274), however, the base plates at four of the eight posts for the rails are cracked through at the bolt locations (Figure 1D-275). The bolts appear to extend through the dropped edges of the solid floor panels, similar to the spiral stair construction; the bolts do not align with the brackets located below the balcony floor (Figure 1D-276).

Figure 1D-275 Cracked base plate at bolt location at rail post at exterior balcony at lantern level.

Figure 1D-276 Rail posts do not align with brackets below lantern balcony floor level.

Discussion

For reasons stated regarding the coating on the Keeper's Dwelling masonry, further investigation into an approatiate coating system is warranted. The coating of the exposed brick should be removed, masonry repairs completed, and the masonry recoated with an appropriate breathable coating.

The interior stair treads are heavily traveled by the public. Cracks in the lattice, occurring at an isolated location within the lattice are not of significant concern. Cracks which extend across multiple lattice sections within a tread or segment are of concern and should be reinforced. Those that have been reinforced with small steel angles below the cracked sections are recommended to be further evaluated.

Figure 1D-277 Metal cladding on the Light Tower with "white" and "black" paint patterns.

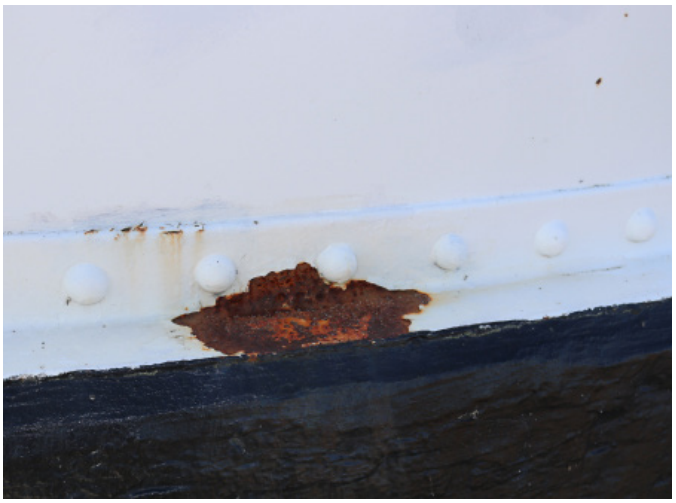

Figure 1D-278 Deteriorated paint finish and corrosion of steel.

Figure 1D-279 Painted "black" stone masonry base of the Light Tower.

Figure 1D-280 "Porthole" style window in the metal cladding surface of the Light Tower.

The guard rail base plate distress should be investigated further for potential cause and repaired as appropriate. The rail is suspected to be relying on its circular shape, engaging multiple posts when a horizontal load is applied to the top of the rail. Considering the public's draw to climb the tower to the exterior balcony of the Lantern level, repair of these base plates should be a high-priority item.

Figure 1D-281 "Porthole" style window in the metal cladding surface of the Light Tower.

The interior plaster should be sounded for loose or unbonded portions and repaired as appropriate.

Figure 1D-282 Interior view of Porthole window and non-extant original rectangular tower window.

EXTERIOR CONDITIONS AND ANALYSIS

The exposed exterior brick walls of the Light Tower were subject to fairly rapid deterioration and metal cladding was installed in the early 1900s. This metal cladding, with its bolted and riveted ribs (Figures 1D-277), provides a robust industrial appearance not often seen on light towers. The condition of the metal cladding is discussed in detail in the structural section of this report, but it is in relatively good condition with some areas of deteriorated paint and rust, such as at this location at the base of the tower (Figure 1D-278). The base of the tower is stone that is painted "black" (Figure 1D-279). The stone is in good condition with some minor areas of mortar deterioration. The paint is in fair condition.

Figure 1D-283 Interior view of Porthole window and non-extant original arch top tower window.

When the metal cladding was installed, the original windows throughout the tower were removed and small porthole style windows installed in the cladding (Figures 1D-280 and 1D-281). These porthole window are brass on the interior and swing in. At the lower level of the tower window hardware remnants reveal in-

swinging rectangular casement windows that were 2 feet 3 inches wide by 3 feet 2 inches high (Figure 1D-282). At the Level 4 Landing below the Watch Deck, there were three in-swinging arch top casement windows also 2 feet 3 inches wide by 3 feet 2 inches high (Figure 1D-283). All porthole windows are in good condition.

At the upper end of the tower below the Watch Deck level, the metal cladding stops, and the brick is exposed between large metal corbels (Figures 1D-284, 1D-285 and 1D-286). This brick is painted "black" and appears to have some mortar joint and paint finish deterioration. The exterior painted brick masonry walls continue at the Watch Deck level (Figure 1D-287). Although the paint finish is in relatively good condition there are numerous spalled bricks, deteriorated mortar joints and other areas of deterioration (Figure 1D-288).

Figure 1D-284 Upper section of the Light Tower with metal corbels, painted brick between the corbels and Watch Deck.

Figure 1D-285 Upper section of the Light Tower with metal corbels, painted brick between the corbels and Watch Deck.

Figure 1D-286 Upper section of the Light Tower with metal corbels, painted brick between the corbels and Watch Deck.

Figure 1D-287 Upper section of the Light Tower showing the Watch Deck/Watch Room and the Lantern.

Access to the exterior Watch Deck from the Watch Room is through a narrow door opening through the 1 feet 5 inches thick brick masonry wall. On the exterior face of the masonry wall there is a 1 feet 8 ½ inches wide by 5 feet 6 inches high by ¼ inches thick steel plate door (Figures 1D-289 and 1D-290). Door hardware on this metal door includes hinges and a latch set with cylindrical knobs (Figure 1D-291). A stone threshold is located between the inner and outer doors (Figures 1D-292). The inner pair of doors are wood with a paint finish, measuring 1 feet 10 ½ inches wide by 5 feet 5 inches high by 1 3/8 inches thick (Figures 1D-293 and 1D-294). A section of the one door is missing, providing a hand-hold, and the paint finish is in poor condition. Hardware is limited to only the hinges.

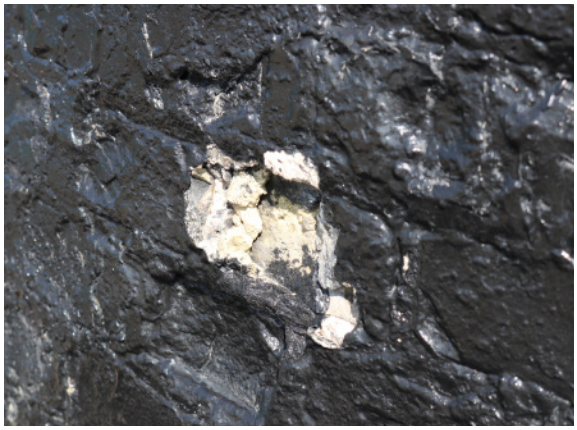

Figure 1D-288 Deteriorated paint surface and damaged brick on the exterior brick masonry wall at the Watch Deck.

Figure 1D-289 Exterior steel plate door providing access from the Watch Room to the exterior Watch Deck.

Figure 1D-290 Exterior steel plate door providing access from the Watch Room to the exterior Watch Deck.

Figure 1D-291 Steel plate door hardware.

Figure 1D-292 Stone threshold between inner and outer doors.

Figure 1D-293 Exterior face of the pair of inner wood doors.

Figure 1D-294 Inner face of the pair of inner wood doors at the Watch Room.

The floor surface of the exterior Watch Deck is cast iron with a paint finish. A section of the deck where a former piece of equipment was mounted is seen in this photograph (Figure 1D-295). The deck is in generally good condition, however, there is one joint on the east side between sections of cast iron that is open approximately 3/8 inches (Figure 1D-296). This open joint has also resulted in cracking of the perimeter deck rail post bracket (Figure 1D-297).

The metal railing on the perimeter of the Watch Deck is 3 feet 4 3/8 inches high with a 2 inches wide by 3/4 inches thick flat bar as the top and bottom rail (Figure 1D-298). Main posts are 1 1/4 inches in diameter and are anchored to the deck with a bracket (Figure 1D-299) and are capped with a 3 1/2 inches decorative ball (figure 1D-300). Balusters are 5/8 inches bars spaced 4 3/4 inches on center. All rail components are painted. The paint finish is in good condition. With the exception of the cracked bracket noted above, all rail components appear in good condition.

The large ten-sided Lantern (Figure 1D-301) is located 6 feet 8 inches above the Watch Deck. The inner dimension of the Lantern is 8 feet 2 inches. The glazing panels in the Lantern are 2 feet 6 1/4 inches wide by 5 feet 11 inches high. The ten openings include three solid metal panels, two panels with “plexiglass” and five glass panels. The two “plexiglass” panels are quite deteriorated. The Lantern is surround by a very narrow exterior cast iron deck that is 1 feet 9 inches at the widest point. A 1 feet 6 3/4 inches high metal railing is located at the outer perimeter of the Lantern Deck (Figure 1D-302). This railing consists of 1-inch diameter posts and a single flat top bar that is 1 1/2 inches wide by 1/2 inches thick (Figure 1D-303). The outer Lantern Deck is typically accessed by a fixed vertical ladder, however, no ladder was present. Hand brackets are mounted to the vertical glazing mullions of the Lantern. The Lantern has

Figure 1D-295 Cast iron floor of the Watch Deck.

Figure 1D-296 Large gap between sections of the cast iron floor at the Watch Deck.

Figure 1D-297 Cracked railing base plate.

Figure 1D-299 Bracket and bottom rail.

Figure 1D-298 Metal railing around the perimeter of the Watch Deck.

Figure 1D-300 Top rail and decorative ball at posts.

Figure 1D-301 Ten-sided Lantern.

a simple curved cast iron cornice with built-in gutters (Figure 1D-304). Open drainage tubes discharge water from the gutters (Figure 1D-305). Some cracking in the cast iron joint, an opening around the drainage tube, and deterioration of the exterior glazing stops is also visible. The paint finish on all metal surfaces of the Lantern is in poor condition as typical at the base at the metal panels (Figure 1D-306).

INTERIOR CONDITIONS AND ANALYSIS

The interior of the Light Tower is a simple 8 feet 0 inch diameter cylinder with a cast iron circular stair and intermittent landings. The center shaft of the stairway is 3 5/8 inches diameter. The tower stair and the single metal handrail that follows the curvature of the stair begin at the main floor level (Figure 1D-307) adjacent to a tower window (Figure 1D-308). Some navigation aids and a navigation light pedestal are stored beneath the stair (Figure 1D-309). Inner tower walls are plaster (Figure 1D-310). A small cast iron door 11 inches wide by 1 feet 5 inches high at a weight shaft is located at the third landing level (Figure 1D-311). The open pattern cast iron stair transitions to a solid metal floor at the fourth landing level, which is entered through a metal floor hatch (Figure 1D-312). A stainless steel grab bar provides assistance to those moving up and down the tower stairs. Built-in wood shelves 2 feet 0 inches wide by 3 feet 3 inches high are also located at this landing (Figure 1D-313) and contain various artifacts. All finishes in this part of the Light Tower are in generally good condition with some minor areas of damaged plaster and peeling paint.

The Watch Room at the Watch Deck level of the Light Tower is also entered through a metal floor hatch (Figure 1D-314). Wall mounted stainless steel grab bars are also located at this hatchway. The floor hatch opening is protected by the 9 1/2 inches diameter navigation light pedestal and a 3 feet 1 1/2 inches high steel guardrail constructed

Figure 1D-302 Metal railing around the perimeter of the Lantern Deck.

Figure 1D-303 Top rail and post at the Lantern Deck railing.

Figure 1D-304 Cast iron cornice of Lantern and safety hand-hold on window mullion.

Figure 1D-305 Gutter drainage tube and cracking at cornice joint.

Figure 1D-306 Base of Lantern with deteriorated paint finish.

Figure 1D-307 Circular stair at the main floor level in the Light Tower.

Figure 1D-308 Light Tower window at main floor level.

Figure 1D-309 Navigation aids stored below the Light Tower stair.

Figure 1D-310 Inner tower plaster walls and circular stair.

Figure 1D-312 Metal floor hatch at the fourth landing level. Note stainless steel grab bar.

Figure 1D-314 Metal floor hatch at the Watch Room. Note stainless steel grab bars.

Figure 1D-311 Metal door for access into a wall cavity. Metal stair handrail is also seen.

Figure 1D-313 Built in wood shelves at the fourth landing level.

Figure 1D-315 Metal guardrail and navigation light pedastal protecting the floor hatch opening.

of 1 1/2 inches square tube (Figure 1D-315). The Watch Room is 7 feet 6 inches in diameter and is lined with 3 inches wide vertical wood paneling with a paint finish (figure 1D-316). A 2 inches high cast iron base is located at the floor. Wood trim caps off the top of the wood paneling below the cast iron Lantern Deck (Figure 1D-317). A 1 feet 9 inches wide curved metal stair (Figure 1D-317A) provides access to the Lantern Deck above. A small wood shelf is located beneath the stair. The paint finish on the wood paneling is in poor condition but in good condition on other surfaces. An additional feature in the Watch Room are five wall ventilators. These ventilators, which are functional and in good condition, are seen from the interior (Figure 1D-318) and exterior (Figure 1D-319) .

Figure 1D-316 Painted wood paneling and metal base in the Watch Room.

Figure 1D-317 Painted wood trim at the top of the wood paneling and the cast iron floor deck of the Lantern.

Figure 1D-317A Curved metal stair for accessing the Lantern.

Figure 1D-318 Lantern ventilator, interior view.

Figure 1D-319 Lantern ventilator, interior view.

Figure 1D-320 Cast iron floor in the Lantern and base of Lantern windows.

Figure 1D-321 View from Lantern looking down into the Watch Room. Note lack of guardrails around the floor opening.

The interior of the Lantern includes the cast iron floor with a checkered pattern (Figure 1D-320) that encircles the perimeter. There are no guardrails around the center opening (Figure 1D-321). Views of the large glass panels (Figures 1D-322, 1D-323 and 1D-324) and east-facing metal panels (Figure 1D-325) are shown. The Lantern frame is constructed of vertical bars 1 inch wide by 2 3/4 inches deep and lower and upper channels (Figures 1D-326 and 1D-327). The Lantern chimney (Figure 1D-328) and interior surfaces of the cast iron Lantern roof and framing (Figure 1D-329) are all painted. All metal surfaces appear sound, however, all interior paint finishes are in poor condition. There is deterioration of the glazing compound around all Lantern glass and metal panels.

Figure 1D-322 Lantern glass panels looking west.

Figure 1D-323 Lantern glass panels looking south.

Figure 1D-324 Lantern glass panels looking north.

Figure 1D-325 East-facing solid metal panels painted "black".

Figure 1D-326 Vertical mullion and base frame around Lantern glass.

Figure 1D-327 Vertical mullion and upper frame around Lantern glass.

Figure 1D-328 Lantern chimney.

Figure 1D-329 View of Lantern ceiling and roof structure.

Figure 1D-330 Interior light fixture at the bottom level of the Light Tower.

Figure 1D-331 Interior light fixture at the Watch Room.

MECHANICAL AND ELECTRICAL SYSTEMS CONDITIONS AND ANALYSIS

There are no mechanical or plumbing systems in the Light Tower. Electrical systems consist of power distribution through surface mounted conduit for interior lights, receptacles, switches and the navigation light. An interior light at the base of the tower (Figure 1D-330) and in the Watch Room (Figure 1D-331) are industrial style fixtures. The LED navigation light (Figure 1D-332) is a "SeaLite" manufactured by Sealite Pty, Ltd. Victoria, Australia, Model No. SL-125-4-W. This light is mounted on a center post with the top of the light 9 feet 7 inches above the Watch Room floor.

Figure 1D-332 "SeaLite" LED navigation light in the Lantern.

LIFE SAFETY SYSTEMS CONDITIONS AND ANALYSIS

There are no life safety systems such as alarms or detectors in the Light Tower. A single wall-mounted fire extinguisher is located in the Watch Room (Figure 1D-317a).

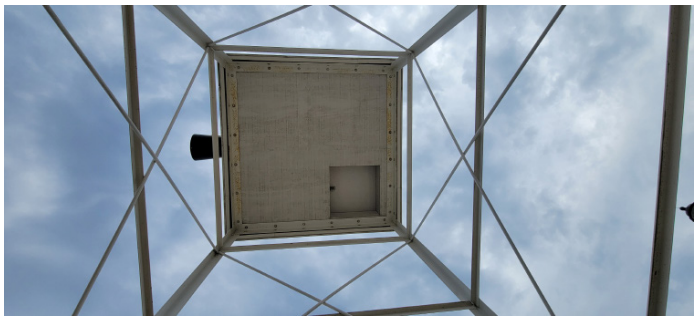

Figure 1D-333 Underside of fog signal superstructure; note roof hatch in northeast corner of floor.

REPLICA FOG SIGNAL TOWER

STRUCTURAL SYSTEM AND ANALYSIS

Access to the interior of the fog signal structure is through a hatch in the wood-framed floor (Figure 1D-333). Ladders of sufficient height were unavailable to safely access this hatch during the site visit, preventing interior access.

Figure 1D-334 Fog signal south elevation.

The braced steel angle tower consists of four corner angle columns oriented to create the truncated pyramid shape of the tower (Figure 1D-334). On each of the four sides, six steel angle horizontal members extend between the corner columns. Round steel bars, fashioned in an "X" pattern, are welded to the interior surfaces of the corner columns at the first, third, and fifth horizontal members from grade, creating two levels of cross bracing for the height of and on each face of the tower (Figure 1D-335 and 1D-336). The corner columns are welded to steel base plates which are anchored to concrete foundations of unknown depth (Figure 1D-337).

Figure 1D-335 Worn coatings and spotted corrosion of the steel tower frame.

Corners are spalled on the top surface of the western concrete foundations (Figure 1D-338). The painted steel angles exhibit no sign of distress beyond spotted corrosion marks through the worn coating surfaces.

The wood-lapped siding and asphalt shingle roofs exhibit no distress as observed from grade and the Light Tower. The brick masonry chimney is flashed with stepped sheet metal flashing where the chimney meets the hip-framed roof (Figure 1D-339).

Figure 1D-337 Southern concrete foundations; note corner is spalled from southwest (left) foundation.

Figure 1D-336 Welded connections of steel bar cross bracing and third set of horizontal angle members located above grade at corner angle column of fog signal tower.

Figure 1D-338 Northwest concrete foundation, top of corner is spalled.

Figure 1D-339 Stepped sheet metal flashing at intersection of masonry chimney and roof of fog signal building.

Sable Points Lighthouse Keepers
Association

PART II: TREATMENT + USE

This section of the Historic Structure Report presents the overall recommended treatment strategy and specific treatment recommendations for the future of the Big Sable Light Station with an emphasis on preserving existing materials and maintaining the longevity of this remote structure. An in-depth study of historic documentation and existing conditions was undertaken to determine the most appropriate treatment strategy and specific treatments for the station.

Part 2 includes the following:

2A - Ultimate Treatment and Use

This section is based on the findings presented in Part 1: Developmental History and SPLKA's intentions for continued programming and use of the station.

The recommended rehabilitation strategy and use plan presented takes into account maintaining character-defining features from the Period of Interpretation; preserving and mitigating the loss of as much original building fabric as possible and, at the same time, providing safe and enjoyable access. A narrative on the four distinct, yet interrelated approaches of the Secretary of the Interior's Standards for the Treatment of Historic Properties (preservation, rehabilitation, restoration and reconstruction) is included for background on the selection of the rehabilitation strategy.

2B - Requirements for Treatment

This section outlines applicable laws, regulations and functional requirements specifically addressing issues of life safety, fire protection, energy conservation, abatement of hazardous materials and handicapped accessibility that meet current code (2015 Michigan Rehabilitation Code for Existing Buildings) requirements.

2C - Specific Treatment Recommendations

This section provides specific treatment recommendations that follow the U.S. Secretary of the Interior's Standards for the Treatment of Historic Properties. These recommendations are prioritized into a phased work schedule according to condition and relation to the overall recommended Ultimate Treatment and Use Plan.

2D - Preliminary Cost Budget Estimates

This section includes cost budget estimates for the treatment recommendations contained in this report.

2A
Ultimate Treatment + Use

This section is based on the findings presented in Part 1; review of the SPLKA website; and discussions with SPLKA staff. The following treatment strategy takes into account SPLKA's intentions and goals for continued stewardship; preserving and interpreting historic features, and allowing safe and enjoyable access.

SABLE POINTS LIGHTHOUSE KEEPERS ASSOC.

SPLKA has the lease to operate and maintain the Big Sable Point Light Station, which is owned by the State of Michigan. SPLKA is a 501(c)(3) non-profit organization that stewards and manages four lighthouses within a thirty mile stretch of Lake Michigan's shoreline near the Ludington area: Big Sable Point, Little Sable Point, Ludington North Breakwater and White River Light Station and Museum. Since 1987, their mission has been the restoration, preservation, education and accessibility of their lighthouse charges. SPLKA has worked diligently over the years to stabilize, restore and maintain the Light Tower and Keepers' Dwelling in accordance with their mission. To further enhance and augment their efforts, SPLKA commissioned this Historic Structure Report to document the history of the structures and site; record existing conditions; and to plan a path for the long-term further restoration and preservation of the light station.

The organization offers a variety of opportunities for which members can volunteer for one to two week resident keeper commitments (tour of service), day keeping shifts, events, and restoration projects. Resident and day keepers are responsible for a variety of tasks including: welcoming guests, historical interpretation, using the cash register to sell tower climb admission tickets and merchandise in the gift shop, manage gift shop inventory and stocking, cleaning, and grounds work. Up to six resident volunteer Lighthouse Keepers serve two-week tours of service at Big Sable Point. SPLKA intends to continue this successful program.

The opportunity to climb the light tower is offered during the months of May through October. The station is accessed by the public by walking along the shore or park road. Making accessibility a priority, SPLKA offers multiple bus days where visitors can ride a bus out to Big Sable Lighthouse from the main parking lot at the entrance of Ludington State Park. Ludington State Park also has motorized tracked wheelchairs to allow assist with accessibility.

Education of the public about the four lighthouses is another focus of SPLKA's mission. SPLKA believes that the youth of today will be the caretakers of our maritime history tomorrow. To support that belief and to aid their mission, SPLKA welcomes educational visits from all sizes and types of school groups. They also provide lesson plans developed by educators and linked to Michigan Content Standards on their website, as well as virtual tours, crafts and activities for children, and other print resources.

SPLKA is interested in exploring the construction of a replica building that is no longer present, such as the former garage and/or boathouse/workshop. These buildings would be utilized to augment interpretive and educational efforts at the station.

TREATMENT STRATEGY (AND USE PLAN)

The Secretary of Interior's Standards are divided into four distinct, yet interrelated approaches to the treatment of historic properties: preservation, rehabilitation, restoration, and reconstruction. Preservation focuses on the maintenance and repair of existing historic materials and retention of a property's form as it has evolved over time. Rehabilitation acknowledges the need to alter or add to a historic property to meet continuing or changing uses while retaining the property's historic character. Restoration depicts a property at a particular period of time in its history, while removing evidence of other periods. Reconstruction re-creates vanished or non-surviving portions of a property for interpretive purposes.

The selection of an appropriate treatment(s) depends on a variety of factors, including the property's historical significance, physical condition, proposed use, and intended interpretation. These factors have been considered in determining the appropriate treatment approach for the Big Sable Point Light Station. Based on this analysis, the recommended treatment approach is rehabilitation with recognition of the Period of Interpretation of 1949 - 1971.

The Secretary of the Interior's Standards for Rehabilitation

The Standards (Department of Interior regulations, 36 CFR 67) pertain to historic buildings of all materials, construction types, sizes, and occupancy and encompass the exterior and the interior, related landscape features and the building's site and environment as well as attached, adjacent, or related new construction. The Standards are to be applied to specific rehabilitation projects in a reasonable manner, taking into consideration economic and technical feasibility. The following is a list of the ten specific standards that have guided the specific treatment recommendations provided in this report.

1. A property shall be used for its historic purpose or be placed in a new use that requires minimal change to the defining characteristics of the building and its site and environment.
2. The historic character of a property shall be retained and preserved. The removal of historic materials or alteration of features and spaces that characterize a property shall be avoided.
3. Each property shall be recognized as a physical record of its time, place, and use. Changes that create a false sense of historical development, such as adding conjectural features or architectural elements from other buildings, shall not be undertaken.
4. Most properties change over time; those changes that have acquired historic significance in their own right shall be retained and preserved.
5. Distinctive features, finishes, and construction techniques or examples of craftsmanship that characterize a property shall be preserved.
6. Deteriorated historic features shall be repaired rather than replaced. Where the severity of deterioration requires replacement of a distinctive feature, the new feature shall match the old in design, color, texture, and other visual qualities and, where possible, materials. Replacement of missing features shall be substantiated by documentary, physical, or pictorial evidence.
7. Chemical or physical treatments, such as sandblasting, that cause damage to historic materials shall not be used. The surface cleaning of structures, if appropriate, shall be undertaken using the gentlest means possible.
8. Significant archaeological resources affected by a project shall be protected and preserved. If such resources must be disturbed, mitigation measures shall be undertaken.
9. New additions, exterior alterations, or related new construction shall not destroy historic materials that characterize the property. The new work shall be differentiated from the old and shall be compatible with the massing, size, scale, and architectural features to protect the historic integrity of the property and its environment.
10. New additions and adjacent or related new construction shall be undertaken in such a manner that if removed in the future, the essential form and integrity of the historic property and its environment would be unimpaired.

RECOMMENDED TREATMENT PHASES

PHASE 1

Further analyze and address material deterioration and deficiencies

Phase 1 work is the highest priority and includes further analyzing and addressing exterior masonry deterioration at the Keepers' Dwelling and Passageway and structural repairs at the Light Tower spiral stair and lantern gallery. It is recommended that this work be completed as soon as funding is available.

PHASE 2

Continued Rehabilitation

Phase 2 work includes continued rehabilitation work. It is recommended that this work be completed within three to five years.

PHASE 3

Visitor Safety and Accessibility Improvements, Enhanced Intrepretation and Visitor Experience

Phase 3 work includes recommended improvements at existing buildings and reconstruction of former buildings from the Period of Interpretation. It is recommended that this work be implemented as funding allows.

Phase 4: Long-Term Renewal

Phase 4 work includes long-term rehabilitation efforts that will eventually be required, including roof replacement and restoration of the windows at the Keepers' Dwelling and Passageway, and tower repainting..

2B Requirements for Treatment

This section outlines applicable laws, regulations and functional requirements, specifically addressing issues of life safety, fire protection, energy conservation, abatement of hazardous materials and handicapped accessibility for existing buildings in the state of Michigan and how they apply to the recommended treatments for the Big Sable Point Light Station.

MICHIGAN REHABILITATION CODE FOR EXISTING BUILDINGS

Background and Applicability of the Code

The Michigan Rehabilitation Code for Existing Buildings (MRCEB) is the applicable governing code for modifications to the Big Sable Point Light Station. The current version is MRCEB 2015, which was adopted by the state on December 13, 2016. The MRCEB adopts by reference, in R 408.30551 of the Michigan Administrative Code, the International Existing Building Code (IEBC) 2015 edition, as published by the International Code Council, Inc. and includes deletions, additions, and amendments specific to the State of Michigan.

Internationally, code officials recognize the need for a modern, up-to-date code addressing repair, alteration, addition or change of occupancy in existing buildings. The IEBC (and subsequent MRCEB) is designed to meet this need through model code regulations that safeguard the public health and safety in all communities, large and small. These comprehensive existing building codes establish minimum regulations for existing buildings using prescriptive and performance-related provisions. The codes are founded on broad-based principles intended to encourage the use and reuse of existing buildings while requiring reasonable upgrades and improvements.

Per [A] 101.2 of the MRCEB, the provisions of the code apply to the repair, alteration, change of occupancy, addition, and relocation of existing buildings. Any new buildings constructed at the station should be designed to meet the requirements of the Michigan Building Code for new construction.

MRCEB CHAPTER 12 FOR HISTORIC BUILDINGS

The Big Sable Point Light Station is listed on the National Register of Historic Places and thus the existing structure is defined as an historic building in the MRCEB. The MRCEB states that historic buildings shall comply with the provisions of Chapter 12 of the MRCEB relating to their repair, alteration, relocation and change of occupancy.

Section 1201 - General Provisions

MRCEB Section 1201 provides general code requirements. Section 1201.2 specifically states that historic buildings that undergo repair, alteration, or change of occupancy shall be investigated and evaluated. Initial investigation and evaluation have been undertaken as part of the preparation of this HSR. If it is determined that compliance with code requirements would be damaging to contributing historic features, a registered design professional may prepare a report describing the feature and demonstrate how an equivalent level of safety is provided.

Section 1202 - Repairs

MRCEB Section 1202 provides requirements for repairs to historic buildings. Repair is defined in the MRCEB as "The reconstruction or renewal of any part of an existing building for the purpose of its maintenance or to correct damage." Repairs include the patching or restoration or replacement of damaged materials, elements, equipment or fixtures for the purpose of maintaining such components in good or sound condition.

Section 1202 indicates that repairs shall be permitted with original or like materials and original methods of construction with the

exception of hazardous materials such as asbestos and lead-based paints. Replacement of existing or missing features using original materials is permitted, as well as partial replacement for repairs that match the original in configuration, height, and size. The intention of the repairs recommended in this HSR is to match the original (original in this case being the configuration, size, color, appearance, etc. of the feature during the Period of Interpretation) as close as practical and technically feasible.

The MRCEB sections relative to repairs states that repairs shall be done in a manner that maintains the level of fire protection provided, the level of protection provided for the means of egress and the level of accessibility. *None of the proposed treatment recommendations reduce the level currently maintained in these areas.*

Section 1202 further states that conditions determined to be unsafe shall be remedied. No work shall be required beyond what is required to remedy the unsafe conditions.

Section 1203 - Fire Safety

Applicable portions of this section include:

1203.3 Means of egress: There is flexibility that if existing door openings and corridor and stairway widths are less than those specified by the code, they may be approved, provided that there is sufficient width and height for a person to pass through the opening or traverse the means of egress.

1203.5 Interior finishes: Existing historic finishes of walls and ceilings are acceptable (and thus do not require fire-resistance rating).

1203.6 Stairway enclosure: The doors leading into and out of the stair enclosure shall be tight-fitting and solid to prevent the spread of smoke.

1203.9 Stairway railings: The existing handrails and guards at the stairs can remain, provided they are not structurally dangerous.

1203.11 Exit signs: Where exit signs would damage the historic character of the building, alternative exit signs are permitted with approval of the code official. Alternative exit signs shall identify the exits and egress path.

Section 1204 - Alterations

Section 1204.1 indicates that the accessibility requirements of the chapters for alterations (specifically Sections 705, 806 and 906), as applicable, shall apply to facilities designated as historic structures that undergo alterations, unless technically infeasible.

The MRCEB designates three levels of alterations to existing buildings:

- Level 1
  Includes the removal and replacement or the covering of existing materials, elements, equipment, or fixtures using new materials, elements, equipment, or fixtures that serve the same purpose.
- Level 2
  Includes the reconfiguration of space, the addition or elimination of any window or door, the reconfiguration or extension of any system, or the installation of any additional equipment.
- Level 3
  Applies where the work area exceeds 50 percent of the building area.

Section 705 of the code applies for these Level 1 alterations, which states that a building, facility, or element that is accessible shall remain accessible. Due to site access to the structure and access between floor levels being only via ladders or stair, the site and integral building are currently not accessible. Therefore, the code does not require them to made such.

Section 806 applies for Level 2 alterations and Section 906 for Level 3. These sections state that a building, facility, or element that is altered shall comply with Section 410. Section 410.9 addresses alternative requirements for historic buildings when compliance with the requirements for accessible routes, entrances or toilet rooms would threaten or destroy the historic significance of the facility.

Section 1205 - Change of Occupancy

Because the existing structures are already utilized as historic structures with the main intent to preserve and interpret them, there will not be a change of occupancy and therefore this section is not applicable.

Section 1206 - Structural

Section 1206 indicates that historic buildings shall comply with the applicable structural provisions of the code. Conditions determined by the code official to be dangerous shall be remedied. A complete structural analysis should be undertaken if the station is to be used for large groups of people.

Hazardous Materials

Any remaining hazardous materials should be removed by licensed contractors utilizing lead safety practices and asbestos abatement procedures and according to local, state and federal regulations. Lead-safety practices include minimizing dust, containing the work area, cleaning up thoroughly and proper disposal. For the small areas of paint removal from metal surfaces, chemical paint removers should be utilized in lieu of blasting.

Energy Conservation

The MRCEB indicates that alterations shall conform to the energy requirements of the International Energy Conservation Code (IECC), without the entire building or structure required to comply with the requirements. It is recommended that any new mechanical, electrical or plumbing systems that are installed meet the IECC.

2C Specific Treatment Recommendations

The following treatment recommendations are based on historic research, site investigations, and the goals of the SPLKA for the continued use and interpretation of the station. These recommendations are prioritized into phases based on condition and relation to the overall recommended Ultimate Treatment and Use. They have been developed to follow the *U.S. Secretary of the Interior's Standards for Rehabilitation.*

PHASE 1

Further analyze and address material deterioration and deficiencies

Phase 1 work is the highest priority and includes further analyzing and addressing exterior masonry deterioration at the Keepers' Dwelling and Passageway and structural repairs at the Light Tower spiral stair and lantern gallery. It is recommended that this work be completed as soon as funding is available.

Keepers' Dwelling and Passageway

Exterior Masonry Repairs and Recoating

- Complete trials of various cleaning methods to remove the existing exterior coatings on the brick masonry. To avoid further degradation of the brick, it is anticipated a chemical means to remove the coating and avoid abrasive blasting will be the selected cleaning method.
- Once the coating is removed, further inspect the mortar and masonry conditions, and complete appropriate masonry repairs. This will include areas of brick replacement and mortar repointing. Where headers are found to be deteriorating, they are to be replaced full length or acceptable alternate means to provide composite action between the brick wythes is to be provided.
- Apply an appropriate breathable coating system for the mass masonry construction.
    - Further evaluation of the wall assembly may be warranted to confirm the use and type of proper coating systems. A WUFI* building sciences analysis is recommended to evaluate the wall assemblies for the intended seasonal uses and variances in the construction materials. Forst dilatometry** (Scrit) testing may also provide further insight into the freeze/thaw resistance of the brick masonry.

      ** WUFI stands for, in German, "Wärme Und Feuchte Instationär", which, translated into English, means heat and moisture transiency. This software is a tool for investigating multiple elements of the building envelope as it relates to heat and moisture transport through the wall system.*

      ***Dilatometryis a laboratory analytical technique using samples from the building to determine the dimensional changes in a material as a function of temperature; typically used to evaluate freeze/thaw action in the materials.*
- As part of reconstructing the brick foundation of the Keepers' Dwelling enclosed north porch, investigate the cause of the sand found within the masonry wall assembly. Temporary shoring and bracing will be required to rebuild the brick masonry along this length of wall. Once rebuilt, apply the appropriate breathable coating as determined through the evaluation noted above.

Restore Chimney

- Remove deteriorated brick and mortar and replace with new, compatible brick masonry. Apply new, appropriate breathable coating.

Light Tower

Spiral Stair Repairs

- Reinforce cracks which extend across multiple lattice sections within a tread or landing segment or, as an alternate, replace the lattice or tread with salvaged or re-cast materials. Replacement of a tread in entirety will require temporary

shoring and coordination between the fabrication shop and the conditions on site.

  - Those that have already been reinforced with small steel angles below the cracked sections are recommended to be further evaluated for their structural capacity and connection to the iron stair system.
  - Continue to monitor the condition of the cracked surfaces on a weekly basis during tourist season until the repairs are completed. Document monitoring with digital photographs and recorded measurements.
  - Remove the existing coating from the stair and evaluate the stair treads and landing segments.

Lantern Gallery Repairs

- Further investigate and analyze the cause of the guard rail base plate distress.
- Repair or replace the base plates appropriately per the investigation and analysis.
  - Continue to monitor the condition of the base plates on a daily basis during tourist season until the repairs are completed. Document monitoring with digital photographs and recorded measurements.
- Address gap in deck plates temporarily to prevent water infiltration into the top of the masonry wall assembly below.

Exterior Masonry Repairs and Recoating

- Complete trials of various cleaning methods to remove the existing exterior coatings on the brick masonry. To avoid further degradation of the brick, it is anticipated a chemical means to remove the coating and avoid abrasive blasting will be the selected cleaning method. Complete trials of various cleaning methods to remove the existing exterior coatings on the exposed stone base and brick lantern walls. To avoid further degradation of the brick and stone, it is anticipated a chemical means to remove the coating and avoid abrasive blasting will be the selected cleaning method.
- Once the coating is removed, further inspect the mortar and masonry conditions, and complete appropriate masonry repairs. This will include areas of brick replacement and mortar repointing. Where headers are found to be deteriorating, they are to be replaced full length or acceptable alternate means to provide composite action between the brick wythes is to be provided.
- Once repairs are complete, apply an appropriate breathable coating as determined through the evaluation noted above.

Metal Cladding

- Complete trials of various cleaning methods to clean and repaint areas of the metal cladding where corrosion is visible. Determine chemistry of existing coating. Apply a rust-inhibitive primer and oil-based finish coat that is compatible with existing paint.

PHASE 2

Continued Rehabilitation and Assessment

Phase 2 work includes continued rehabilitation work. It is recommended that this work be completed within three to five years.

Keepers' Dwelling

Localized painting

- Scrape areas of deterioration and paint wood shingles at porches and dormers.

Repaint exterior wood doors

- Clean and repaint two wood panel doors and thresholds at entry porches.
- Clean and repaint three wood storm doors at entries.
- Clean and repaint wood panel door and trim at basement stair exit door.

Assess foundation walls and repair, if needed

- Remove the storage shelves against the masonry foundation walls to allow full assessment of the walls and repair cracks if present.
- If cracks are present, consider removing soil along a small length of the wall to assess the exterior condition of the walls prior to repairing. Ideally this could be completed if/when utilities or other site work is to occur.

Roof Assessment

- Complete a preliminary structural analysis of the roof structure to evaluate the observed sagging of the roof structure under its own weight and snow loads per current design codes.

Passageway

Expansion Joint at Light Tower

- Design and install joints between the passageway and tower to allow for differential movement to occur. A full depth expansion joint may not be appropriate at the connection to the tower for lateral stability of the passageway structure. Repointing with two lifts of mortar and a third lift of sealant provides for load transfer and stability with the sealant providing limits to bulk water infiltration as the masonry walls move.

Replace Door

- Replace exterior door with wood panel door to match configuration during the Period of Interpretation.

Repair and repaint exterior stairs

- Patch areas of spalled concrete and repaint stairs

Paint floor

- Clean and repaint the brick and concrete floor

Light Tower

Exterior Masonry Repairs and Recoating

- Complete trials of various cleaning methods to remove the existing exterior coating on the brick at the top of the tower (above the metal cladding, between corbels). To avoid further degradation of the brick and stone, it is anticipated a chemical means to remove the coating and avoid abrasive blasting will be the selected cleaning method..
- Once the coating is removed, further inspect the mortar and masonry conditions, and complete appropriate masonry repairs. This will include areas

of brick replacement and mortar repointing. Where headers are found to be deteriorating, they are to be replaced full length or acceptable alternate means to provide composite action between the brick wythes is to be provided.

- Once repairs are complete, apply an appropriate breathable coating as determined in Phase 1.

Interior Plaster Repairs and Painting

- Sound the interior plaster and repair loose or unbonded portions.
- Refer to NPS Preservation Brief #21, "Repairing Historic Flat Plaster - Walls and Ceilings."
- Clean, properly prepare and Paint all plaster surfaces.

Lantern Restoration

- Restore all interior and exterior components of the Lantern.
  - Remove deteriorated paint on all metal components by lightly blasting to white metal. A blasting media appropriate for lead-based paint should be used.
  - Remove Lantern glass prior to metal restoration and painting.
  - Clean, properly repair and paint all metal surfaces. Apply marine-grade paint system consisting of zinc-rich primer, epoxy intermediate coat and polysiloxane finish coat.
  - Replace two Plexiglass panels with new glass.
  - Reinstall glass after painting work is complete. Install sealant in all exterior seams.

Watch Deck Level Repairs and Painting

- Restore the inner pair of wood doors at the Watch Deck level leading to the exterior Watch Deck Gallery.
- Clean and paint, patch/repair the opening cut in one door and install new door hardware.
- Repaint the wood paneling at the walls.

Site

- Clean and repaint flagpole with high quality, marine grade paint system.

Replica Fog Signal Tower

- Paint the Skeletal Metal Frame of the Replica Fog Signal Building.
  - Remove deteriorated paint and rust on all metal components of the steel skeletal frame by lightly blasting to white metal. Clean, properly prepare and paint all metal surfaces with a high quality, marine grade paint system.

PHASE 3

Visitor Safety and Accessibility Improvements, Enhanced Intrepretation and Visitor Experience

Phase 3 work includes recommended improvements at existing buildings and reconstruction of former buildings from the Period of Interpretation. It is recommended that this work be implemented as funding allows.

Keepers' Dwelling

Exit Signage and Egress Lighting

- Install code-compliant exit signage and egress lighting in the first floor areas that are open to the public for interpretation and gift shop.

First Floor Accessibility

- Install a new exterior wood ramp on the north side of the Keepers' Dwelling and install a raised floor in the North Porch to provide an accessible route through the North Porch allowing access to the first floor Gift Shop and exhibit and interpretative spaces, Passageway and base level of the Light Tower.
- If accessibility is desired in the first floor apartment, a door opening could be added in the north-south wall between the gift shop and foyer.

Passageway

- Install code-compliant exit signage and egress lighting.

Light Tower

- Install code-compliant egress lighting.

Site

- Install interpretive signage throughout the site to further explain the development of the historic site. Identify buildings and structures no longer present.

Reconstruction of Former Buildings

Reconstruct the garage, the small brick oil house and/or the workshop (relocated and converted boathouse). The programming for these buildings may include interpretative displays, educational space, and/or storage. Though original construction drawings for these buildings have not been located, review of historic site plans and photographs provide information for replication of their site placement; overall size and configuration; exterior materials; and fenestration.

Archeological research and field survey should be completed to identify if any remains of the former building foundations remain and to identify if there are any other subsurface artifiacts in the proposed areas of construction.

The light station is located in a State of Michigan Critical Dune Area (CDA); designated as a barrier dune. A Department of Great Lakes, Environment, and Energy (EGLE) permit is required for activities that significantly alter a CDA, including the construction of a building.

PHASE 4

Long-Term Renewal

Phase 4 work includes long-term rehabilitation efforts that will eventually be required, including repainting the tower metal cladding; roof replacement; and restoration of the windows at the Keepers' Dwelling and Passageway, and tower repainting.

Light Tower

Metal Cladding

- Clean and repaint the exterior metal cladding surface and associated repairs.
  - Sandblast to remove all existing paint and any underlying rust. A blasting

media appropriate for lead-based paint should be used.

- Once cleaned, undertake an assessment of the metal cladding and fasteners. Complete repairs as required.
- Apply rust-converter coating at small areas of corrosion that cannot be removed)such as tight joints).
- Apply marine-grade paint system consisting of zinc-rich primer, epoxy intermediate coat and polysiloxane finish coat.

Keepers' Dwelling

Restore all wood windows

- Remove deteriorated glazing putty and replace.
- Paint all interior and exterior surfaces of the sash and frames.
- Clean all existing hardware.
- Restore all windows to proper operating condition.
- Remove all screen and storm sash throughout the Keepers' Dwelling and replace with new wood combination screen/storm units.

Roof Replacement

The roof was last replaced in 2017. The typical lifespan for asphalt shingles in Michigan ranges from 15 - 25 years. SPLKA should therefore plan for replacement in approximately 2032 - 2042.

It is recommended to replace in-kind with red asphalt shingles and mock Yankee gutters representing the Period of Interpretation. In addition to replacing the roofing, it is recommended that roof framing members spliced within their span be reinforced with 2x members extending full length. This may be best completed during the reroofing project, as access to the framing from the interior attic space is difficult.

Per the initial assessment for this HSR, further assessment is also recommended during the reroofing project, when there is better access to the roof framing.

- Further investigate the water staining at the south dormer at the east half of the roof to determine if water is actively infiltrating the roofing system and to determine the strength of the existing wood members.

Passageway

- Replace roof.
- Restore the wood window in the Passageway in same manner as Keepers' Dwelling.

Concrete Walkways

- The concrete walkways around the Keepers' Dwelling and Tower, and the extension to the former garage location were last replaced in the late 1990s. While they remain in good condition, they will eventually deteriorate under the shifting sand and environmental conditions. It is recommended to consult historic photographs and drawings to match location, configuration, and concrete finish when they are replaced. If any replica buildings are reconstructed, it is recommended to construct replica concrete walkways to them in the historic locations.

ON-GOING MAINTENANCE & MONITORING

Light Tower

- Continue to monitor the condition of the cracked stair tread and landing surfaces on a weekly basis during tourist season until the repairs are completed.
- Continue to monitor the condition of the guard rail base plates at the lantern gallery on a weekly basis during tourist season until the repairs are completed.

Keepers' Dwelling

- Monitor the basement slab-on-ground annually and document any changes. This can be done by SPLKA or DNR personnel with digital photographs and simple tools (level, tape measure); or more precise monitoring systems such as the installation of crack monitors. Examples of changes to document include if water migrates up through existing cracks; if the vertical displacement increases in magnitude; if existing cracks increase in width or length; and/or if new cracks form.
    - If these changes in conditions occur, it is recommended to grout the voids below the slab solid and replace localized, affected areas with a new four to five inch thick, reinforced concrete slab.
- Continue to monitor the basement foundation walls for re-cracking or other distress on an annual basis.
- Continue to monitor cracking in the plaster and gypsum board walls and ceilings at the first and second floors on an annual basis. Should the cracks worsen, a professional engineer or architect should be consulted. Repairs of the cracks are feasible, but should, ideally, allow for seasonal movement of the structure and building materials.
- Monitor and maintain the connections of the metal hand rail and conditions of the steps at the entrances to the building.
- Engage a qualified contractor to complete an assessment and certificiation of the boiler system. Frequency of future subsequent assessments per the recommendation of the contractor.
- Engage a qualified electrical engineer to inspect the electrical system and implement any recommended repairs to address identified expired complainants and/or significant deviations from current codes.

Passageway

- Monitor and maintain the connections of the metal hand rail and conditions of the steps at the west entrance.
- Continue to monitor the floor for additional displacement; alternatively, reset the pavers to address any potential tripping hazard.

Site

Shoreline Protection

- Monitor the steel sheet pile shore protection for signs of deterioration, damage, or displacement.

Replica Fog Signal Tower

- Obtain access to the interior of the space on a bi-annual basis to verify condition of space.
- Clean and recoat braced steel angle tower as regular maintenance of the structure.

Concrete Walkways

- Remove vegetation from joints, cracks, and adjacent to foundation on a regular basis to prevent potential concrete heaving and spalling.
- Monitor for potential trip hazards due to cracks, displacement, or spalling.

2D Preliminary Cost Budget Estimates

This section includes budgetary costs for the treatment recommendations contained in this report. The estimates are construction costs only and based on current dollars, i.e., assuming that the work will take place in 2024. All costs are preliminary and based on the level of detail understood and presented in this HSR. Therefore, a twenty percent design and construction contingency is included in the overall costs. The following is not included:

- Escalation for inflation if work takes place beyond 2024.
- Additional mobilization, general conditions, overhead and other contractor costs associated with undertaking the work in multiple phases beyond those delineated herein.
- Contractor bonds costs.
- Long distance travel, lodging, food and other costs incurred by non-local contractor.
- Cost of architectural and engineering services unless specifically noted. It is recommended that 12% to 15% of the construction costs for each specific project be budgeted for architectural and engineering fees for design, bidding assistance and construction administration services.
- Costs for interpretive signage or displays.
- Fundraising costs.
- Donations and costs incurred for volunteer efforts
- Permit fees.

PHASE 1: Further analyze and address material deterioration and deficiencies

Keepers' Dwelling and Passageway

Removal of Existing Coatings from brick and stone surfaces	$125,000
Localized Masonry Repairs (brick replacement and repointing) *Assumes 10% brick replacement and repointing 20% of mortar joints*	$210,000
Rebuild brick foundation of north wall of north enclosed porch	$25,000
Recoat all brick and stone masonry	$50,000
Restore Chimney	$25,000

Light Tower

Spiral Stair Repairs - Reinforce cracks at treads and landings	$7,500
Lantern Gallery Repairs	
Replace guard rail base plates *For budgeting purposes, conservatively assumes replacement rather than repair*	$26,000
Temporarily address gap in deck plates* *Placeholder for sheet metal flashing and sealant to keep water out until long-term solution*	$3,000
Exterior Masonry Repairs and Recoating - Stone base and brick lantern base *Assumes repointing 20% of mortar joints*	$15,000
Clean and repaint areas of the metal cladding where corrosion is visible *Assumes required at 5% of surface area*	$9,500
Phase 1 Construction Cost Subtotal	$496,000
Contractor General Conditions (10%)	$50,000
Contractor Overhead and Profit (10%)	$50,000
Design and Construction Contingency (20%)	$100,000
Phase 1 Estimated Project Cost	$696,000

Estimated Engineering Assessment and Analysis Costs

Research and analysis to determine appropriate breathable coating for masonry	$30,000
Spiral stair tread structural capacity and connection evaluation	$12,000
Research and analysis to determine cause of damage and determine appropriate repair recommendations for guard rail base plate and separated deck plates ** This analysis needs to be completed to determine long-term/permanent repair*	$25,000
TOTAL ESTIMATED PHASE 1 PROJECT COST	**$763,000**

PHASE 2: Continued Rehabilitation and Assessment

Keepers' Dwelling

Repaint wood shingles at porches and dormers	$12,000
Clean and repaint two wood panel doors and thresholds at entry porches	$3,000
Clean and repaint three wood storm doors at entries	$4,000
Clean and repaint wood panel door and trim at basement stair exit door	$1,500

Passageway

Replace exterior door	$5,500
Install mortar and sealant joints between the passageway and tower and at the stone masonry header over the west doorway	$4,500
Repair and repaint exterior stairs	$3,000
Paint brick and concrete floor	$4,000

Light Tower

Exterior Masonry Repairs and Recoating - Top of the tower shaft, between corbels *Assumes 20% brick replacement and repointing 20% of mortar joints*	$30,000
Localized plaster repairs and repaint interior of tower walls	$28,000
Repaint the wood paneling at Watch Room walls	$3,600
Restore and repaint the Watch Room doors	$4,500
Lantern Restoration	$75,000

Site

Clean and repaint flagpole	$2,500

Replica Fog Signal Tower

Clean and repaint skeletal metal frame	$20,000

Phase 2 Construction Cost Subtotal	$201,100
Contractor General Conditions (10%)	$20,000
Contractor Overhead and Profit (10%)	$20,000
Design and Construction Contingency (20%)	$40,000
Phase 2 Estimated Project Cost	$281,100
TOTAL ESTIMATED PHASE 2 PROJECT COST	**$282,000**

PHASE 3: Visitor Safety and Accessibility Improvements and Enhanced Intrepretation and Visitor Experience

Keepers' Dwelling

Install exit signage and egress lighting at first floor public areas	$9,500
Construct a new exterior wood ramp on the north	$11,000
Install raised floor in North Porch	$8,500

Passageway

Install exit signage and egress lighting	$4,000

Light Tower

Install egress lighting	$7,500

Site

Install interpretive signage (allowance)	$5,000

Phase 3 Construction Cost Subtotal	$45,500
Contractor General Conditions (10%)	$4,600
Contractor Overhead and Profit (10%)	$4,600
Design and Construction Contingency (20%)	$9,200
Phase 3 Estimated Project Cost	$64,000

Alternate Costs

Install door between gift shop and foyer	$8,500
Reconstruct former boathouse / workshop*	$125,000 - $200,000
Reconstruct former garage*	$150,000 - $225,000
Reconstruct former small brick oil house*	$65,000 - $85,000

* *Does not include archeology costs or permit fees.*

TOTAL ESTIMATED PHASE 3 PROJECT COST	**$412,500 - $583,000**

PHASE 4: Long-Term Renewal

Keepers' Dwelling and Passageway

Replace roof	$75,000
Reinforce spliced wood framing roof joists	$7,500
Restore windows	$175,000
Install new wood combination screen/storm units	$50,000

Light Tower

Clean and repaint the exterior metal cladding surface and associated repairs.	$400,000

Phase 4 Construction Cost Subtotal	$707,500
Contractor General Conditions (10%)	$71,000
Contractor Overhead and Profit (10%)	$71,000
Design and Construction Contingency (20%)	$142,000
Phase 4 Estimated Project Cost	$992,000

Estimated Engineering Assessment and Analysis Costs

Investigate the water staining at the south dormer; strength analysis	$15,000

TOTAL ESTIMATED PHASE 4 PROJECT COST	**$1,007,000**

Sable Points Lighthouse Keepers
Association

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Figure Credits

SPLKA website: SPLKA logo used throughout HSR

Part 1A

Figure 1A-01: Table created by O|X Studio and Smay Trombley Architecture.

Figure 1A-02: "U.S. lighthouse typology chronology" provided on page 14 of Candace Clifford, ed. USDI/NPS NRHP Multiple Property Documentation Form: "Light Stations in the United States" (2002).

Figure 1A-03: Sapulski, Wayne S., Lighthouses of Lake Michigan: Past and Present. Manchester, MI: Wilderness Adventure Books, 2001.

Figure 1A-04: Partsolutions.com, "The Million Dollar Lens: The Science and History behind the Fresnel Lighthouse Lens," Cadenas Part Solutions, http://partsolutions.com, accessed November 16, 2017.

Figure 1A-05: Smay Trombley Architecture, "St. Joseph Inner and Outer Lights Historic Structure Report," Final Draft Report, 2016.

Figure 1A-06: http://drlps.com/history/aids-to-navigation/

Figure 1A-07: North Manitou Lightkeepers

Figures 1A-08 and 1A-09: United States Coast Guard Historian's Office Archives, Washington, DC.

Figure 1A-10: Michelle Smay, Smay Trombley Architecture, July 2023.

Part 1B

Figures 1B-01 – 1B04, 1B-09, 1B-10, 1B-12, 1B-13, 1B-18, 1B-20 – 1B-24, 1B-28: C.E.U. Cleveland, Coast Guard Buildings and Lighthouses, Michigan-Lake Michigan, Big Sable Point Light Station drawings held at the National Archives II, College Park, MD.

Figures 1B-06, 1B-19, 1B-27, 1B-29, 1B-32, 1B-33, 1B-36 through 1B-41, 1B-43 through 1B-46, 1B-49, 1B-51, 1B-53, 1B-54, 1B-57 through 1B-61, 1B-63, 1B-70, 1B-71, 1B-73, 1B-81, 1B-82, 1B-89, 1B-90 through 1B-103: SPLKA Archives

Figure 1B-05: Michelle Smay, Smay Trombley Architecture, taken circa 1994 for Quinn Evans Architects

Figure 1B-07: Michelle Smay, Smay Trombley Architecture, 2017.

Figure 1B-08: Michelle Smay, Smay Trombley Architecture, 2023.

Figure 1B-11: National Archives online catalog, downloaded summer 2023.

Figures 1B-14 – 1B-16, 1B-25, 1B-26, 1B-34, 1B-35, 1B-42, 1B-47, 1B-48, 1B-50, 1B-62, 1B-64, 1B-75, 1B-83, 1B-84, 1B-85, 1B-86, 1B-82: United States Coast Guard Historian's Office Archives, Washington, DC.

Figure 1B-17: Grace Truman, president, S.O.S. Vermilion; former SPLKA board member. Undated.

Figures 1B-30 and 1B-31, 1B-52, 1B-55, 1B-56, 1B-65, 1B-66, 1B-67, 1B-68, 1B-69, 1B-72, 1B-74, 1B-76 through 80 : C.E.U. Cleveland, Coast Guard Buildings and Lighthouses, Michigan-Lake Michigan, Big Sable Point Light Station drawings held at the National Archives II, College Park, MD.

Figure 1B-88: Vintage Aerial, https://vintageaerial.com

Figure 1B-104: Bryan Lijewski, FAIA, Michigan State Historic Preservation Office

Part 1C

Figures 1C-01, 1C-02, 1C-26, 1C-27: United States Coast Guard Historian's Office Archives, Washington, DC.

Figures 1C-3 through 1C-10, 1C-15 through 1C-17, 1C-19 through 21, 1C-24, 1C-25: SPLKA Archives

Figures 1C-11 through 14, 1C-18: Michelle Smay, Smay Trombley Architecture, 2023.

Figure 1C-22: C.E.U. Cleveland, Coast Guard Buildings and Lighthouses, Michigan-Lake Michigan, Big Sable Point Light Station drawings held at the National Archives II, College Park, MD.

Figure 1C-23: Sanders & Czapski Associates, PLLC

Figure 1C-28: Google maps, accessed summer 2023.

Part 1D

All photos included in Part 1D were taken by team members from Sanders & Czapski Associates, PLLC, Smay Trombley Architecture and WJE during July 17 - 20 site visit.

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APPENDICES

The following Appendix items are included:

- National Register Nomination Form
- Paint Research Report - Color Analysis
- Environmental Laboratory Paint Analysis Report
- 1908 and 1948 construction drawings
- Existing Conditions Drawings
- Paint Sample Location Drawings

Lighthouse Multiple Resource Inventory Sheet

Form No. 10-306 (Rev. 10-74)

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

NATIONAL REGISTER OF HISTORIC PLACES INVENTORY -- NOMINATION FORM

FOR FEDERAL PROPERTIES

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SEE INSTRUCTIONS IN *HOW TO COMPLETE NATIONAL REGISTER FORMS*
TYPE ALL ENTRIES -- COMPLETE APPLICABLE SECTIONS

1 NAME

HISTORIC: United States Coast Guard Lighthouses and Light Stations on the Great Lakes

AND/OR COMMON:

2 LOCATION

STREET & NUMBER: Multiple locations in Illinois, Michigan, Minnesota, New York, Ohio, Pennsylvania, and Wisconsin

CITY, TOWN: ___ NOT FOR PUBLICATION

CONGRESSIONAL DISTRICT:

STATE: ___ VICINITY OF

CODE:

COUNTY:

CODE:

3 CLASSIFICATION

CATEGORY	OWNERSHIP	STATUS	PRESENT USE	
___DISTRICT	X PUBLIC	X OCCUPIED	___AGRICULTURE	___MUSEUM
X BUILDING(S)	___PRIVATE	X UNOCCUPIED	___COMMERCIAL	___PARK
X STRUCTURE	___BOTH	___WORK IN PROGRESS	___EDUCATIONAL	___PRIVATE RESIDENCE
___SITE	**PUBLIC ACQUISITION**	**ACCESSIBLE**	___ENTERTAINMENT	___RELIGIOUS
___OBJECT	___IN PROCESS	X YES RESTRICTED	X GOVERNMENT	___SCIENTIFIC
	___BEING CONSIDERED	X YES UNRESTRICTED	___INDUSTRIAL	X TRANSPORTATION
		X NO	___MILITARY	___OTHER

4 AGENCY

United States Coast Guard, U.S. Department of Transportation

REGIONAL HEADQUARTERS *(If applicable)*

STREET & NUMBER: 400 7th Street SW

CITY, TOWN: Washington ___ VICINITY OF

STATE: District of Columbia

5 LOCATION OF LEGAL DESCRIPTION

COURTHOUSE, REGISTRY OF DEEDS, ETC: United States Coast Guard Ninth District Headquarters

STREET & NUMBER: 1240 East Ninth Street

CITY, TOWN: Cleveland

STATE: Ohio 44199

6 REPRESENTATION IN EXISTING SURVEYS

TITLE: Historic American Engineering Record Great Lakes Lighthouse Survey (see attached forms)

DATE: 1979

X FEDERAL ___STATE ___COUNTY ___LOCAL

DEPOSITORY FOR SURVEY RECORDS: H.A.E.R., 440 G Street NW

CITY, TOWN: Washington

STATE: District of Columbia

7 DESCRIPTION

CONDITION		CHECK ONE	CHECK ONE
__EXCELLENT	__DETERIORATED	__UNALTERED	__ORIGINAL SITE
__GOOD	__RUINS	__ALTERED	__MOVED DATE_____
__FAIR	__UNEXPOSED		

See individual forms.

DESCRIBE THE PRESENT AND ORIGINAL (IF KNOWN) PHYSICAL APPEARANCE

The theme of this nomination is the design and construction of lighthouses and light stations on the Great Lakes prior to 1930. The nominated buildings and structures were essential to the rapid expansion of Great Lakes maritime commerce from the 1850's through the 1920's. They illustrate the evolution of lighthouse design and construction methods in response to the changing requirements of Great Lakes shipping as the volume of traffic increased, routes changed, and the size and speed of ships increased.

The nomination is based on the buildings and structures identified in the Historic American Engineering Record Great Lakes Lighthouse Survey conducted for the United States Coast Guard between March and September 1979. The survey was limited from the outset to light towers, lighthouses, and light stations owned by the U.S. Coast Guard and not previously included on the National Register of Historic Places. Sites with no above-ground remains were excluded from the survey, as were sites where neither light tower nor lighthouse were extant. With a few exceptions, no structures built after 1930 were included in the survey. There are approximately 2,500 "aids to navigation" on the Great Lakes, but the vast majority of these are buoys and lights mounted on piles or poles. Virtually all of these buoys and pole lights are of recent vintage and none were considered in the survey.

The H.A.E.R. survey was conducted by Carol Poh Miller, an architectural historian with several years' experience in engineering history and industrial archeology, including work on several H.A.E.R. inventories in Cleveland, and Dr. Charles K. Hyde, a historian of technology with seven years' experience on numerous H.A.E.R. inventories and recording projects. The two surveyors identified a total of one hundred and one (101) lighthouses or light stations in all eight states bordering of the Great Lakes.

Several criteria were used for inclusion in this thematic nomination. Lights which were significant to the growth of general navigation on the Great Lakes, specifically coastal lights, major harbor lights (e.g., in Chicago, Cleveland, and Buffalo), and reef/shoal lights were nominated. Less significant harbor lights were included if they incorporated innovative designs. Finally, the nomination includes several lights which are significant because of innovative construction techniques used in their erection. They were built in remote locations, most notably on isolated reefs and shoals.

The historical integrity of the surviving buildings and structures was a major criterion used for selection. The minimum requirement was that the lighthouse or light tower be structurally intact. Total integrity of buildings, structures, and equipment is nonexistant for Great Lakes light stations because of modernization and automation. Nowhere for example has nineteenth-century steam-driven fog signal equipment survived. The original lenses are extant at about one-half of the sites, but the conversion to electrical illumination in the twentieth century eliminated the original oil vapor or acetylene illuminating apparatus. All of the lenses which were originally turned by mechanical clockwork systems are now driven by electric motors. Nevertheless, the properties are essentially coherent, i.e., the major buildings and structures are intact. Light stations where most of the major buildings are not standing were excluded from the nomination.

Using these criteria, a total of fifty properties were selected. They are listed below by state.

(continued on next sheet)

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Illinois

Chicago Harbor Light Station

Michigan

Big Sable Point Light Station
Detroit River Light Station
Eagle Harbor Light Station
Forty Mile Point Light Station
Grand Traverse Light Station

Granite Island Light Station
Gull Rock Light Station
Harbor Beach Light
Isle Royale Light Station
Little Sable Point Light Station

Manitou Island Light Station
Marquette Harbor Lighthouse
Pointe Betsie Light Station
Port Sanilac Light Station
Presque Isle Light Station

Rock of Ages Light Station
Saginaw River Light Station
Seul Choix Point Light Station
Skillagallee (Ile Aux Galets) Light Station
Sturgeon Point Light Station

St. Martin Island Light Station
Tawas Point Light Station
Thunder Bay Island Light Station
Waugoshance Light Station
White Shoal Light Station

Minnesota

Duluth South Breakwater Inner Light
Two Harbors Light Station

New York

Buffalo Main Light
Buffalo North Breakwater South End Light
Dunkirk Light
Fort Niagara Light
Galloo Island Light
South Buffalo North Side Light
Thirty Mile Point Light
Tibbetts Point Light

Ohio

Ashtabula Harbor Light
Cedar Point Light
Cleveland West Pierhead Light
Toledo Harbor Light
West Sister Island Light

Pennsylvania

Presque Isle Light

Wisconsin

Ashland Breakwater Light
LaPointe Light Station
North Point Light Station
Plum Island Rear Range Light
Rawley Point Light Station
Sherwood Point Light Station
Sturgeon Bay Canal Light
Wind Point Light Station

8 SIGNIFICANCE

PERIOD	AREAS OF SIGNIFICANCE -- CHECK AND JUSTIFY BELOW				
__PREHISTORIC	__ARCHEOLOGY-PREHISTORIC	__COMMUNITY PLANNING	__LANDSCAPE ARCHITECTURE	__RELIGION	
__1400-1499	__ARCHEOLOGY-HISTORIC	__CONSERVATION	__LAW	__SCIENCE	
__1500-1599	__AGRICULTURE	__ECONOMICS	__LITERATURE	__SCULPTURE	
__1600-1699	__ARCHITECTURE	__EDUCATION	__MILITARY	__SOCIAL/HUMANITARIAN	
__1700-1799	__ART	X ENGINEERING	__MUSIC	__THEATER	
X 1800-1899	X COMMERCE	__EXPLORATION/SETTLEMENT	__PHILOSOPHY	X TRANSPORTATION	
X 1900-	__COMMUNICATIONS	__INDUSTRY	__POLITICS/GOVERNMENT	__OTHER (SPECIFY)	
		__INVENTION			

SPECIFIC DATES 1832-1919 BUILDER/ARCHITECT Various

STATEMENT OF SIGNIFICANCE

In the early nineteenth century the Great Lakes became the most important single transportation system in the United States and has retained its importance to the present. The completion of the Erie Canal in 1825 opened a direct cheap route between the Middle West and the Atlantic Coast. Within a few years after this event there was an enormous growth in shipments of grain, lumber, and coal from west to east, while manufactured goods moved in the opposite direction. The Great Lakes transportation system was not fully developed until 1855, when the St. Mary's Falls Ship Canal at Sault Ste. Marie opened, linking Lake Superior with the Lower Lakes. This immediately touched off the rapid development of the enormous iron ore and copper deposits found on Lake Superior. On the eve of the Civil War the Great Lakes system was a vital part of the American economy, linking the natural resources and agricultural lands of the Middle West with the industrialized East Coast and the rest of the world. According to one estimate, the value of products traded on the Great Lakes in 1856 was approximately $600 million, more than the total value of American foreign trade.

Great Lakes commerce continued to expand rapidly throughout the rest of the nineteenth century and retained its significance to the national economy. Shipments increased sharply from 6 million tons in 1870 to over 80 million tons by 1911, while the value of trade rose more slowly, by about 430 percent. This slower growth reflected declining price levels and a simultaneous shift in the composition of trade. Lumber and grains had accounted for three-quarters of the tonnage shipped in the 1870's, but by 1911 they accounted for less than one-tenth of the total. Over the same period, iron ore shipments increased in importance, accounting for half the total tonnage by 1911, while coal made up another quarter. In 1910, when virtually all the output from the Lake Superior iron mines was shipped by water, these mines accounted for seventy percent of U.S. iron ore production. The development of major iron and steel plants at Gary, Buffalo, Cleveland, and Detroit during the last quarter of the nineteenth century was a direct result of the Great Lakes transportation system, which permitted the economical movement of iron ore and coal over great distances.

The development of Great Lakes lighthouses and other aids to navigation not only paralleled the growth in commerce, but was a prerequisite for that growth. The construction and maintenance of lighthouses has been a Federal Government responsibility since 1789, when Congress created the Lighthouse Establishment and placed it under the jurisdiction of the Secretary of the Treasury. Responsibility for aids to navigation remained in the Treasury Department until 1903, when the Lighthouse Service was transferred to the newly-created Department of Commerce and Labor. Finally in 1939 the Lighthouse Service was merged with the U.S. Coast Guard, which has retained jurisdiction over lighthouses to this day.

(continued)

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The construction of lighthouses on the Great Lakes began in earnest after the Erie Canal opened. Only four lighthouses were built in 1818-1822, seven more were added in 1825-1829, but the first real boom took place in the 1830's, when thirty-four were built. Construction slowed the following decade when only twenty new lights were added to the system, but then quickened in the 1850's when thirty-eight new lighthouses were built. On the eve of the Civil War the Great Lakes had a total of one hundred and two lighthouses. Their distribution reflected the relative importance of the individual Lakes at that time. Lake Michigan had a total of thirty-three lights, Lake Erie had twenty-nine, while Lakes Superior, Ontario, and Huron had fourteen, eleven, and ten respectively. There were an additional five lights on the Detroit River and Lake St. Clair. Two-thirds of these structures marked harbor or river entrances, while the rest were placed on islands, points, and dangerous shoals and reefs.

As commerce expanded after the Civil War, particularly on Lake Superior, so did the need for additional lighthouses. The increased volume of traffic and the growth in the size of ships made improved lighting of treacherous areas like the Straits of Mackinac, the St. Mary's River, and the Detroit River imperative. The total number of Great Lakes lighthouses more than tripled between 1860 and the end of the century, by which time there were 333 lighthouses and eleven lightships in service. Lake Michigan had the most lighthouses (ninety-six), but Lake Superior was close behind with ninety-one, not including nearly fifty additional lights on the St. Mary's River. Lake Erie was a distant third with forty-eight lights, reflecting the changed orientation of Lake traffic toward Lake Superior. Most lighthouse construction after 1900 involved rebuilding or relocating existing structures and replacing lightships with permanent light stations. The lighthouse system in use today is essentially the structures which were in place in the early twentieth century, with modernized, automated lighting systems added later.

Lighthouse design evolved gradually during the nineteenth century, with considerable variations between harbor and coast lights. The most common design before 1870 consisted of a frame or brick Keeper's Dwelling with the light exhibited in a lantern mounted either directly atop the dwelling or on an attached square tower standing twenty-five to forty feet tall. This was not however a universal design. Where taller towers were required, usually for coastal lights, conical masonry (usually brick) structures were built, normally connected to the Keeper's House by an enclosed passageway. There were also a few large skeletal iron towers such as the one at Manitou Island (1861) built during this era. Initially there were considerable variations in lantern designs, including the widespread use of the "birdcage" lantern, but by the 1870's the polygonal lantern, usually with eight or ten sides, had become nearly universal on the Lakes.

There were also significant changes in illuminants and lenses prior to 1870. At the beginning of the century sperm oil was the principal illuminant, but as the sperm whale population declined, rapeseed oil was substituted. Immediately after the Civil War, lard

oil became the standard source of light. The lenses used in lighthouses were a more important and controversial matter. The U.S. government adopted the Argand lamp and parabolic reflector system for its lighthouses after purchasing the patent rights from Captain Winslow Lewis in 1812. The French physicist Augustus Fresnel developed a radically different and superior lens in 1822, incorporating a series of glass prisms surrounding the light source in a beehive configuration. A central prism magnified the light while prisms above and below refracted light to yield a single powerful beam.

The Lighthouse Establishment, directed by the Fifth Auditor of the Treasury, did not make any significant effort to adopt the Fresnel lens for thirty years. A single lens of the new type was purchased in 1841, but ten years later there were only three in use in the United States. The Fifth Auditor, Stephen Pleasanton, adamantly resisted the Fresnel lens and was responsible for its slow adoption. He was ultraconservative, technically ignorant, and a close friend of Winslow Lewis. At outraged Congress eventually investigated the Lighthouse Establishment in 1851 and the following year created the Lighthouse Board, dominated by military officers, engineers, and scientists. They moved quickly to adopt the Fresnel lens, which not only produced a superior light, but was also more economical to operate. Seventy-five Great Lakes lighthouses were refitted with Fresnel lenses between 1854 and 1857 and all new ones built after 1854 were similarly equiped. This became the standard lens for the rest of the century and there are still more than one hundred of these in service on the Great Lakes.

Lighthouse design evolved in several distinct directions after the Civil War. Beginning in the 1870's harbor lights were moved from the mainland onto the piers and breakwaters that were being built, necessitating a change in their design. Pier lights, while still manned, no longer included a residence which typically remained on shore, so simple wooden or skeletal iron structures sufficed. Few of these have survived because numerous pier extensions and the destructive effects of storms and ice shortened their lives. In the first two decades of this century virtually all the harbor lights were replaced with steel-framed structures encased in cast iron or steel plates. Beginning in the mid-1920's the unenclosed skeletal steel tower or post with an exposed lens lantern became the dominant form.

Coastal and island lights requiring tall light towers evolved more slowly. With a few exceptions, the conical brick tower was the typical design used before 1900. Individual towers one hundred feet tall, requiring massive walls were not uncommon, although there were also significant examples of skeletal steel towers. After the turn of the century there were few tall towers built and these all utilized steel frames.

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The greatest challenge faced by lighthouse designers in the period 1870-1910 was the construction of light stations on isolated islands, reefs, and shoals. The Lighthouse Establishment had its own staff of engineers attached to the three Great Lakes districts and these were usually men with experience as military engineers. When a proposed lighthouse presented particularly difficult engineering problems, the U.S. Army Corps of Engineers would assign additional personnel to work on the project. They became expert in the design and construction of offshore lights resting on submarine crib structures beginning with the building of the Waugoshance Shoal Light (1851) and including major engineering feats at Spectacle Reef (1874), Stannard Rock (1882), and the Detroit River Light (1885). The culmination of these efforts to design and build structures under difficult conditions was the completion of the light station at White Shoal (1910), a project which received considerable attention from the national engineering community.

Lenses and illuminants have also changed considerably since the 1870's. The Fresnel lens was virtually the only type used until the 1910's, when a variety of new types gradually came into use, primarily in new light towers. These included locomotive lenses, airport beacon styles, and a variety of lens lanterns which could be exposed to the elements. Kerosene was introduced as an illuminant in 1877 and by the mid-1880's had largely replaced lard oil. Incandescent lamps were used experimentally beginning in the 1890's and acetylene gas after 1902, but kerosene and other oils remained the dominant illuminant until the 1920's, when the majority of lights were converted to electrical illumination. Increased electrification of isolated areas and the development of improved portable engines and generators made the conversion to electricity virtually complete by the Second World War.

9 MAJOR BIBLIOGRAPHICAL REFERENCES

(see continuation sheet)

10 GEOGRAPHICAL DATA

ACREAGE OF NOMINATED PROPERTY (see individual forms)

UTM REFERENCES

	ZONE	EASTING	NORTHING
A			
B			
C			
D			

VERBAL BOUNDARY DESCRIPTION

LIST ALL STATES AND COUNTIES FOR PROPERTIES OVERLAPPING STATE OR COUNTY BOUNDARIES

STATE	CODE	COUNTY	CODE
STATE	CODE	COUNTY	CODE

11 FORM PREPARED BY

NAME / TITLE

Professor Charles K. Hyde

ORGANIZATION
For H.A.E.R. and the U.S. Coast Guard

DATE
15 October 1979

STREET & NUMBER
Dept. of History, Wayne State University

TELEPHONE
(313) 577-2525

CITY OR TOWN
Detroit

STATE
Michigan 48202

12 CERTIFICATION OF NOMINATION

STATE HISTORIC PRESERVATION OFFICER RECOMMENDATION

YES____ NO____ NONE____

STATE HISTORIC PRESERVATION OFFICER SIGNATURE

In compliance with Executive Order 11593, I hereby nominate this property to the National Register, certifying that the State Historic Preservation Officer has been allowed 90 days in which to present the nomination to the State Review Board and to evaluate its significance. The evaluated level of significance is ____National ____State ____Local.

FEDERAL REPRESENTATIVE SIGNATURE

TITLE

DATE

FOR NPS USE ONLY

I HEREBY CERTIFY THAT THIS PROPERTY IS INCLUDED IN THE NATIONAL REGISTER

DATE

DIRECTOR, OFFICE OF ARCHEOLOGY AND HISTORIC PRESERVATION

ATTEST:

DATE

KEEPER OF THE NATIONAL REGISTER

GPO 899-214

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

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CONTINUATION SHEET ITEM NUMBER PAGE

In the National Register of Historic Places information leaflet, the general criteria for listing a property in the National Register of Historic Places are as follows:

"The quality of significance in American history, architecture, archeology, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association, and:

A. that are associated with events that have made a significant contribution to the broad patterns of our history; or

B. that are associated with the lives of persons significant in our past; or

C. that embody the districtive characteristics of a type, period, or method of construction, or that represent a significant and distinguishable entity whose components may lack individual distinction; or

D. that have yielded, or may be likely to yield, information important in prehistory or history.

In evaluating the significance of lighthouses on the Great Lakes, it is apparent that Criteria A and C are the most applicable. It is also apparent that essentially all lighthouses embody the distinctive characteristics of a type, period, or method of construction and that practically all lighthouses on the Great Lakes could conceivably be eligible for the National Register of Historic Places under Criteria C.

Both of the historians responsible for the preparation of this nomination believe listing of all lighthouses on the Great Lakes in the National Register to be inappropriate. Both have been responsible for the preparation of National Register nomination forms prior to this study and believe they ahve an understanding of how the criteria can be fairly and judiciously applied to the lighthouses of the Great Lakes. Without question, arguments could be made that lighthouses not included in this nomination could have local historical significance and thus could be eligible for the National Register. Similarly, archeologists could argue that lighthouse sites no longer retaining standing structures might be likely to yield information important to history or prehistory, and thus be eligible for the National Register. Nonetheless, this study recommends the following fifty lighthouses for nomination to the National Register of Historic Places.

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

NATIONAL REGISTER OF HISTORIC PLACES INVENTORY -- NOMINATION FORM

FOR NPS USE ONLY
RECEIVED
DATE ENTERED

Holland, Francis Ross, Jr. America's Lighthouses: Their Illustrated History Since 1716. Brattleboro, Vermont: Stephen Green Press, 1972.

Mansfield, J.B. History of the Great Lakes, Volume I. Chicago: J. Beers & Company, 1899.

O'Brien, T. Michael. Guardians of the Eighth Sea: A History of the U.S. Coast Guard on the Great Lakes. Washington, D.C.: U.S. Government Printing Office, 1976.

Strobridge, Truman R. Chronology of Aids to Navigation and the Old Lighthouse Service, 1716-1939. Washington, D.C.: U.S. Government Printing Office, 1974.

Taylor, George Rogers. The Transportation Revolution, 1815-1860. New York: Holt, Rinehart and Winston, 1951.

U.S. Coast Guard, Light List, IV, Great Lakes. Washington, D.C.: U.S. Government Printing Office, 1978.

U.S. Light-House Establishment. Light List For 1858. Washington, 1858.

Williamson, Samuel H. "The Growth of the Great Lakes as a Major Transportation Resource, 1870-1911," in Paul Uselding, Editor, Research in Economic History, II, pp. 173-248. Greenwich, Connecticut: Jai Press, 1977.

1. SITE I.D. NO

HAER INVENTORY

Historic American Engineering Record
Department of the Interior, Washington, D.C.

2. INDUSTRIAL CLASSIFICATION: TRANS: MARINE: Nav. Aids — 5 5 0 1

3. PRIORITY: 1

4. DANGER OF DEMOLITION? (SPECIFY THREAT) ☐ YES ☒ NO ☐ UNKNOWN

5. DATE: 1867-1905

6. GOVT SOURCE OF THREAT: OWNER ADMIN

7. OWNER/ADMIN: United States Coast Guard, DOT

8. NAME(S) OF STRUCTURE: Big Sable Point (Grande Point au Sable) Light Station

9. OWNER'S ADDRESS: 400 7th Street SW
Washington, D.C. 20590

10. STATE: MI — COUNTY: — COUNTY NAME: Mason — CITY/VICINITY: Hamlin Twp. — CONG. DIST.:

STATE — COUNTY — COUNTY NAME — CITY/VICINITY — CONG. DIST.

11. SITE ADDRESS (STREET & NO.): On Big Sable Point

12. EXISTING SURVEYS: ☐ NR ☐ NHL ☐ HABS ☒ HAER—I ☐ HAER ☐ NPS ☐ CL6
☐ CONF ☐ STATE ☐ COUNTY ☐ LOCAL ☐ OTHER

13. SPECIAL FEATURES (DESCRIBE BELOW)
☒ INTERIOR INTACT ☒ EXTERIOR INTACT ☐ ENVIRONS INTACT

14. UTM ZONE: 16 — EASTING: 538015 — NORTHING: 4878015 — SIGN — SCALE: ☐ 1:24 ☒ 1:62.5 ☐ OTHER _____ — QUAD NAME: Manistee

UTM ZONE — EASTING — NORTHING — SIGN — SCALE: ☐ 1:24 ☐ 1:62.5 ☐ OTHER _____ — QUAD NAME

15. CONDITION: 70 ☐ EXCELLENT 71 ☒ GOOD 72 ☐ FAIR 73 ☐ DETERIORATED 74 ☐ RUINS 75 ☐ UNEXPOSED 76 ☐ ALTERED 82 ☐ DESTROYED 85 ☐ DEMOLISHED

16. INVENTORIED BY: Charles K. Hyde — AFFILIATION: HAER-Great Lakes Lighthouse Survey — DATE: 7/30/1979

17. DESCRIPTION AND BACKGROUND HISTORY, INCLUDING CONSTRUCTION DATE(S), HISTORICAL DATE(S), PHYSICAL DIMENSIONS, MATERIALS, EXTANT EQUIPMENT, AND IMPORTANT BUILDERS, ENGINEERS, ETC.

The Lighthouse Board noted in 1865 that Grand Pointe au Sable was "the most salient point on the eastern shore of Lake Michigan, between Point Betsey and Muskegon" that remained unlighted and observed that "the interests of commerce demand that it be suitably lighted." Congress appropriated funds for this project in July 1866 and construction was completed the following year, with the light first exhibited on 1 November 1867. The conical brick tower was threatened by beach erosion within two years after it was built, but a longer-term problem was the deterioration of the brickwork. The tower was repointed in 1880, but the problem was not permanently solved until 1900, when the entire tower up to the watchroom was encased in steel plates, with the space between the plates and the brickwork filled with concrete. The tower was encased with eighteen rings of steel plates, with each ring stepped back from the one beneath it. The individual plates, 3/8 inch thick at the bottom of the tower, but only (CONT OVER)

18. ORIGINAL USE: Coast Light — PRESENT USE: Coast Light — ADAPTIVE USE:

19. REFERENCES—HISTORICAL REFERENCES, PERSONAL CONTACTS, AND/OR OTHER

U.S. Department of Commerce and Labor, Light-House Establishment, "Description of Buildings, Premises, Equipment, etc.," Record Group 26, National Archives, Report of 8 June 1909; Clippings Files from the Annual Reports of the U.S. Lighthouse Service, Record Group 26, National Archives; Engineering Drawing, "Project for Metal Casing for Tower, 12 April 1899," Engineering Department, U.S. Coast Guard Ninth District Headquarters, Cleveland, Ohio (CONT OVER)

20. URBAN AREA 50,000 POP. OR MORE? ☐ YES ☒ NO

21. HCRS REGION

22. PUBLIC ACCESSIBILITY ☐ YES, LIMITED ☐ YES, UNLIMITED ☒ NO ☐ UNKNOWN

23. EDITOR / INDEXER

24. LOCATED IN AN HISTORIC DISTRICT? ☐ YES ☒ NO NAME — DISTRICT I.D. NO

1. SITE I.D. NO

HAER INVENTORY

Historic American Engineering Record
Department of the Interior, Washington, D.C.

2. INDUSTRIAL CLASSIFICATION: TRANS: MARINE: Nav. Aids — 5 5 0 1

3. PRIORITY: 1

4. DANGER OF DEMOLITION? (SPECIFY THREAT) ☐ YES ☒ NO ☐ UNKNOWN

5. DATE: 1867-1905

6. GOVT SOURCE OF THREAT: OWNER ADMIN

7. OWNER/ADMIN: United States Coast Guard, DOT

8. NAME(S) OF STRUCTURE: Big Sable Point (Grande Point au Sable) Light Station

9. OWNER'S ADDRESS: 400 7th Street SW
Washington, D.C. 20590

10. STATE: MI — COUNTY: — COUNTY NAME: Mason — CITY/VICINITY: Hamlin Twp. — CONG. DIST.:

STATE — COUNTY — COUNTY NAME — CITY/VICINITY — CONG. DIST.

11. SITE ADDRESS (STREET & NO.): On Big Sable Point

12. EXISTING SURVEYS: ☐ NR ☐ NHL ☐ HABS ☒ HAER—I ☐ HAER ☐ NPS ☐ CL6
☐ CONF ☐ STATE ☐ COUNTY ☐ LOCAL ☐ OTHER

13. SPECIAL FEATURES (DESCRIBE BELOW)
☒ INTERIOR INTACT ☒ EXTERIOR INTACT ☐ ENVIRONS INTACT

14. UTM ZONE: 16 — EASTING: 538015 — NORTHING: 4878015 — SIGN — SCALE: ☐ 1:24 ☒ 1:62.5 ☐ OTHER _____ — QUAD NAME: Manistee

UTM ZONE — EASTING — NORTHING — SIGN — SCALE: ☐ 1:24 ☐ 1:62.5 ☐ OTHER _____ — QUAD NAME

15. CONDITION: 70 ☐ EXCELLENT 71 ☒ GOOD 72 ☐ FAIR 73 ☐ DETERIORATED 74 ☐ RUINS 75 ☐ UNEXPOSED 76 ☐ ALTERED 82 ☐ DESTROYED 85 ☐ DEMOLISHED

16. INVENTORIED BY: Charles K. Hyde — AFFILIATION: HAER-Great Lakes Lighthouse Survey — DATE: 7/30/1979

17. DESCRIPTION AND BACKGROUND HISTORY, INCLUDING CONSTRUCTION DATE(S), HISTORICAL DATE(S), PHYSICAL DIMENSIONS, MATERIALS, EXTANT EQUIPMENT, AND IMPORTANT BUILDERS, ENGINEERS, ETC.

The Lighthouse Board noted in 1865 that Grand Pointe au Sable was "the most salient point on the eastern shore of Lake Michigan, between Point Betsey and Muskegon" that remained unlighted and observed that "the interests of commerce demand that it be suitably lighted." Congress appropriated funds for this project in July 1866 and construction was completed the following year, with the light first exhibited on 1 November 1867. The conical brick tower was threatened by beach erosion within two years after it was built, but a longer-term problem was the deterioration of the brickwork. The tower was repointed in 1880, but the problem was not permanently solved until 1900, when the entire tower up to the watchroom was encased in steel plates, with the space between the plates and the brickwork filled with concrete. The tower was encased with eighteen rings of steel plates, with each ring stepped back from the one beneath it. The individual plates, 3/8 inch thick at the bottom of the tower, but only (CONT OVER)

18. ORIGINAL USE: Coast Light — PRESENT USE: Coast Light — ADAPTIVE USE:

19. REFERENCES—HISTORICAL REFERENCES, PERSONAL CONTACTS, AND/OR OTHER

U.S. Department of Commerce and Labor, Light-House Establishment, "Description of Buildings, Premises, Equipment, etc.," Record Group 26, National Archives, Report of 8 June 1909; Clippings Files from the Annual Reports of the U.S. Lighthouse Service, Record Group 26, National Archives; Engineering Drawing, "Project for Metal Casing for Tower, 12 April 1899," Engineering Department, U.S. Coast Guard Ninth District Headquarters, Cleveland, Ohio (CONT OVER)

20. URBAN AREA 50,000 POP. OR MORE? ☐ YES ☒ NO

21. HCRS REGION

22. PUBLIC ACCESSIBILITY ☐ YES, LIMITED ☐ YES, UNLIMITED ☒ NO ☐ UNKNOWN

23. EDITOR / INDEXER

24. LOCATED IN AN HISTORIC DISTRICT? ☐ YES ☒ NO NAME — DISTRICT I.D. NO

NPS Form 10-900-a
(3-82)

OMB No. 1024-0018
Exp. 10-31-84

United States Department of the Interior
National Park Service

National Register of Historic Places Inventory—Nomination Form

For NPS use only
received
date entered

Continuation sheet | Item number | Page 10/5

Multiple Resource Area
Thematic Group

dnr-11

Name U.S. Coast Guard Lighthouses and Light Stations on the Great Lakes TR
State IL, MI, MN, NY, OH, PA, & WI

	Nomination/Type of Review			Date/Signature
IL	1. Chicago Harbor Lighthouse	Substantive Review Entered in the National Register	for Keeper Attest	Arlene Byers 7/19/84
MI	2. Big Sable Point	Entered in the National Register	for Keeper Attest	Arlene Byers 8/4/83
	3. Detroit River (Bar Point) Light Station	Substantive Review	Keeper Attest	Beth Grosvenor 8/4/83
	4. Eagle Harbor Light Station	Entered in the National Register	for Keeper Attest	Arlene Byers 7/19/84
	5. Forty Mile Point Light Station	Substantive Review Entered in the National Register	for Keeper Attest	Arlene Byers 7/19/84
	6. Grand Traverse (Cat's Head Point) Light Station	Entered in the National Register	for Keeper Attest	Arlene Byers 7/19/84
	7. Granite Island Light Station	Substantive Review	Keeper Attest	Beth Grosvenor 8/4/83
	8. Gull Rock Light Station	[illegible]	for Keeper Attest	Arlene Byers 7/19/84
	9. Harbor Beach (Sand Beach) Lighthouse	Substantive Review	Keeper Attest	Beth Grosvenor 8/4/83
	10. Isle Royale Light Station	Entered in the National Register	for Keeper Attest	Arlene Byers 8/4/83

FEDERAL

WASO Form - 177
("R" June 1984)

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

NATIONAL REGISTER OF HISTORIC PLACES
EVALUATION/RETURN SHEET

Big Sable Point (Grande Point au Sable) Light Station (U.S. Coast Guard Lighthouses and Light Stations on the Great Lakes TR)
Mason County
MICHIGAN

Working No. 6/21/83
Fed. Reg. Date: 2-7-84
Date Due: 7/21/83 - 8/5/83
Action: ✓ ACCEPT 8/4/83
___ RETURN
___ REJECT
Federal Agency: 4S Coast Guard DOT

Entered in the National Register

☐ resubmission
☐ nomination by person or local government
☐ owner objection
☐ appeal

Substantive Review: ☐ sample ☐ request ☐ appeal ☐ NR decision

Reviewer's comments:

Recom./Criteria ___
Reviewer ___
Discipline ___
Date ___
___ see continuation sheet

Nomination returned for: ___ technical corrections cited below
___ substantive reasons discussed below

1. Name

2. Location

3. Classification

Category	Ownership	Status	Present Use
	Public Acquisition	Accessible	

4. Owner of Property

5. Location of Legal Description

6. Representation in Existing Surveys

Has this property been determined eligible? ☐ yes ☐ no

7. Description

Condition		Check one	Check one
☐ excellent	☐ deteriorated	☐ unaltered	☐ original site
☐ good	☐ ruins	☐ altered	☐ moved date ___
☐ fair	☐ unexposed		

Describe the present and original (if known) physical appearance

☐ summary paragraph
☐ completeness
☐ clarity
☐ alterations/integrity
☐ dates
☐ boundary selection

8. Significance

Period Areas of Significance—Check and justify below

Specific dates Builder/Architect
Statement of Significance *(in one paragraph)*

☐ summary paragraph
☐ completeness
☐ clarity
☐ applicable criteria
☐ justification of areas checked
☐ relating significance to the resource
☐ context
☐ relationship of integrity to significance
☐ justification of exception
☐ other

9. Major Bibliographical References

10. Geographical Data

Acreage of nominated property _____
Quadrangle name _____
UTM References

Verbal boundary description and justification

11. Form Prepared By

12. State Historic Preservation Officer Certification
The evaluated significance of this property within the state is:

____ national ____ state ____ local

State Historic Preservation Officer signature

title date

13. Other

☐ Maps
☐ Photographs
☐ Other

Questions concerning this nomination may be directed to _____

Signed _____ Date _____ Phone: _____

Comments for any item may be continued on an attached sheet

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

MANISTEE QUADRANGLE
MICHIGAN
15 MINUTE SERIES (TOPOGRAPHIC)

3772 I
(ONEKAMA)

3772 IV
(BAR LAKE)

(LUDINGTON)
3771 IV

(FREESOIL)
3772 II

(CUSTER)
3771 I

SCALE 1:62500

Mapped, edited, and published by the Geological Survey

Control by USGS and USC&GS

Topography from aerial photographs by photogrammetric methods
Aerial photographs taken 1954. Field check 1958
Hydrography compiled from U. S. Lake Survey charts 77 (1957) and 776 (1954)

Polyconic projection. 1927 North American datum
10,000-foot grid based on Michigan coordinate system, central zone
1000-meter Universal Transverse Mercator grid ticks, zone 16, shown in blue

Red tint indicates areas in which only landmark buildings are shown

UTM GRID AND 1958 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 20 FEET
DOTTED LINES REPRESENT 10-FOOT CONTOURS
DATUM IS MEAN SEA LEVEL
DEPTH CURVES AND SOUNDINGS IN FEET—DATUM IS 578 FEET

ROAD CLASSIFICATION

Heavy-duty
Medium-duty
Light-duty
Unimproved dirt
U. S. Route
State Route

QUADRANGLE LOCATION

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, WASHINGTON, D. C. 20242
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

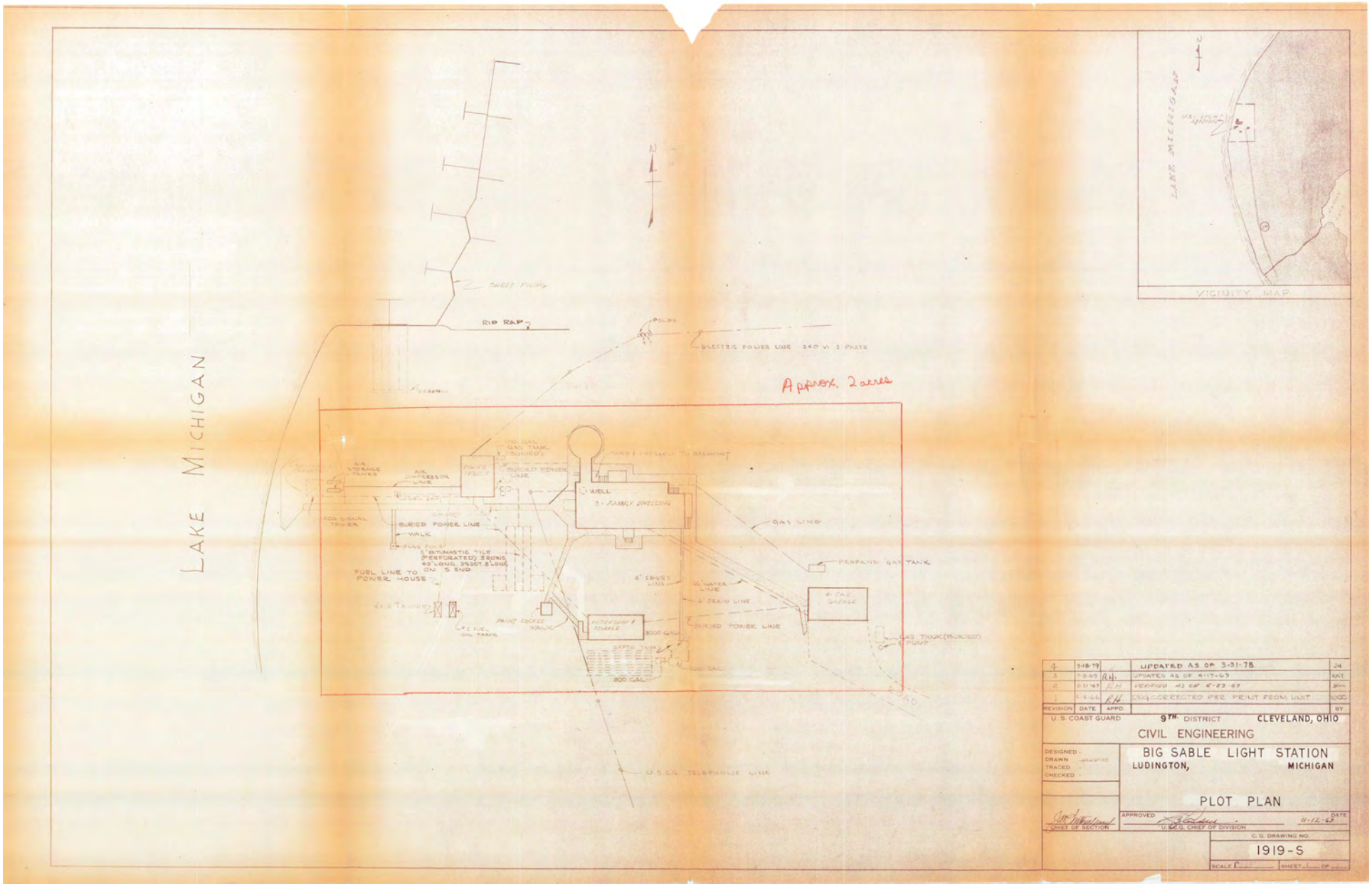
MANISTEE, MICH.
N4400—W8615/15

1958

AMS 3772 III—SERIES V762

INTERIOR-GEOLOGICAL SURVEY, WASHINGTON, D. C.- 1971

BIG SABLE PT
N 48-78,200
E 5-38,650
16/533845/4878120



REVISION	DATE	APPD.		BY
4	7-18-79		UPDATED AS OF 3-31-78.	JH
3	7-3-69	RH	UPDATED AS OF 4-17-69	KAT
2	5-31-67	EH	VERIFIED AS OF 5-23-67	
1	5-4-66	RH	UNCORRECTED PER PRINT FROM UNIT	NOC

U.S. COAST GUARD — 9TH DISTRICT — CLEVELAND, OHIO

CIVIL ENGINEERING

DESIGNED
DRAWN
TRACED
CHECKED

BIG SABLE LIGHT STATION
LUDINGTON, MICHIGAN

PLOT PLAN

CHIEF OF SECTION

APPROVED
U.S.C.G. CHIEF OF DIVISION
DATE 11-12-69

C. G. DRAWING NO.
1919-S

SCALE 1" = 100' SHEET 1 OF 1

Steven C Seebohm
HISTORIC FINISHES CONSULTATION

Big Sable Lighthouse Paint Research Report October 17, 2023

8800 /W M-116
Ludington, Michigan

Executed for:
Ken Czapki
Sander & Czapki Associates
109 S Front Street, #210
Marquette, MI 49855

Introduction

This report documents the results of interior and exterior paint analysis of the Big Sable Lighthouse Tower, Passageway and Dwelling. The purpose of the analysis is to provide a color match to the 1950 paint campaign, and does not provide color or medium analysis, or earlier or later color campaigns.

Paint samples were harvested by Ken Czapski of Sanders & Czapski Associates, 109 S Front Street, #210, Marquette, Michigan. Samples were received from Sanders & Czapski on August 7, 2023 and analyzed from August 19 to September 30, 2023.

Microscopic analysis was executed using a 10x – 20x *Meiji* binocular microscope with a *Stocker & Yale* illuminator. Based on the chronology documentation provided by Michelle Smay, the 1950 historic finish color layer was identified and matched to the *Munsell Color Notation System* glossy edition.

Analysis Results

The results of the analysis listed below begins with the name of the architectural feature/element, followed by most relevant historic information, and the *Munsell Color Number*.

Big Sable Lighthouse Sample Record

1. Exterior – Red Brick – North Elevation @ NE Corner
    a. Brick installed 1948, painted 1949
    b. 1950 color believed to be *Munsell #N5 Grey*
2. Exterior – Yellow Brick on North Wall
    a. Brick installed 1908, painted 1942
    b. Same as sample #1

3. Exterior – Brick Foundation @ North Porch – Paint on Mortar
    a. North Wall Brick installed 1908, painted 1942
    b. *Munsell #10Y 9/1* - White
4. Exterior – West Wall – Yellow Brick near SE Corner
    a. Brick installed 1867, painted 1942
    b. Same as #3
5. Exterior – North Wall of East Porch – Wood Shingle Siding
    a. Wood shingles installed 1908, painted 1941
    b. Same as sample #3
6. Passageway to Tower – South Wall – Concrete Steps
    a. Constructed 1920, not sure when painted
    b. Same as sample #1 (followed by deep red coats)
7. Exterior – Tower – Stone Base of Tower
    a. constructed 1867, don't think painted until 1960s
    b. *Munsell #N0.75 Black* (Contemporary) – Believed not painted in 1950
8. Dwelling - First Floor – Closet – SE Side Wood base trim
    a. Constructed 1908; likely repainted in 1949 with alterations
    b. *Munsell #2.5Y 8.5/2 Cream* (over shellac/varnish – wood substrate)
9. Dwelling - Kitchen (South) – Wood Wainscot – West Wall (behind range)
    a. installed 1908
    b. Same as sample #8
10. Dwelling - BR – Closet wood base trim
    a. Constructed and painted1948-49
    b. Same as sample #8
11. Dwelling - Office – Wood base trim
    a. 1948-49 addition
    b. Same as sample #8 – Possible reuse of old molding
12. Exterior – Window Sill in Kitchen
    a. installed 1908, painted 1942
    b. Same as sample #3 (all layers)
13. East Dwelling 1st Floor – Base Trim on Landing down to Basement
    a. 1908
    b. Same as sample #8
14. West Dwelling – 1st Floor Interior – Door Casing
    a. 1867
    b. Same as sample #3 (very few layers)
15. West Dwelling – 1st Floor – Closet – Door Casing
    a. 1867
    b. Same as sample #8

16a. West Dwelling – North Porch – Wood Wainscot Cap
    a. 1908
    b. Same as sample #8

16b. West Dwelling – Living Room – Baseboard Trim
    a. 1867
    b. Same as sample #8
16. West Dwelling – Storage Porch – Painted Wood Floor
    a. 1908
    b. Same as sample #1
17. West Dwelling – 2nd Floor – Electrical Closet – Wainscot Cap
    a. not sure if 1908 or 1948/49
    b. Same as sample #3
18. East Dwelling – 2nd Floor – Electrical Closet – Door Casing
    a. 1948-49
    b. Same as sample #3
19. East Dwellng – 2nd Floor – Closet – Baseboard
    a. 1948/49
    b. Same as sample #3
20. East Dwelling – 2nd Floor – Closet – Base Trim
    a. 1908
    b. Same as sample #3
21. East Dwelling – 2nd Floor – Closet – Base Trim
    a. 1948/49
    b. Same as sample #3
22. West Dwelling – 2nd Floor – Closet west side – Wood Base Trim
    a. 1948/49
    b. Same as sample #3
23. West Dwelling – Bedroom #4 – Wood Base Trim
    a. 1948/49
    b. Same as sample #3
24. Tower – Ground Floor – Interior Window Frame
    a. 1867
    b. Same as sample #3
25. Tower – Ground Floor – Wall
    a. 1867
    b. Same as sample #3 (previous layers of black & red)

26. Tower – Ground Floor – Painted Concrete Floor
    a. 1867
    b. Same as sample #3
27. Tower – Lantern Deck Level – Interior Wood Paneling
    a. 1867
    b. Same as sample #3

28. Tower – Lantern Deck Level – Interior Pair Wood Doors to Deck
    a. 1867
    b. Same as sample #3
29. Tower – Lantern Deck Level – Metal Jamb between Inner & Outer Door
    a. 1867
    b. Same as sample #3
30. Dwelling – Exterior – Wood Shingle Siding – Single Story Addition – North Side
    a. 1908, painted 1941
    b. Same as sample #3

December 18, 2023

Mr. Ken Czapski
Sanders & Czapski Associates, PLLC
109 Front Street, Suite 210
Marquette, MI 49855

BIG SABLE LIGHTHOUSE - ENVIRONMENTAL LABORATORY PAINT ANALYSIS

Dear Ken:

As requested by Sanders & Czapski, Associates, PLLC (S&C), a laboratory lead analysis for paint samples from Big Sable Lighthouse was completed. The purpose of the lead analysis was to document lead concentrations in the paint samples collected, bagged, and labeled by S&C from the Big Sable Lighthouse on October 14, 2023.

This letter documents and summarizes laboratory testing results completed by Schneider Laboratories Global, Inc. for lead testing on paint samples from the Big Sable Lighthouse. This letter is not intended to be a lead paint survey, rather an analysis of the paint samples provided for lead analysis.

Thirty-one bulk paint samples were provided on November 8, 2023 in individual labeled containers. The samples were submitted to Schneider Laboratories Global, Inc., Richmond Virginia on December 5, 2023 and analyzed using Method EPA 7000B for total lead as specified on the chain-of-custody included with the laboratory report (Appendix A).

The sample number, structure, description, and laboratory results of the samples submitted for lead testing are included in Table 1, 29 of the 31 samples submitted paint samples contained detectable lead concentrations. As noted on select samples, substrate was present with a portion of the samples.

Table 1: Laboratory Lead Paint Results
Big Sable Lighthouse

Sample Number	Sample Location, Description, Paint Color	Lead Content (mg/Kg)
1	Dwelling Exterior Red Brick - White	53.8
2	Dwelling Exterior Yellow Brick - White	30.5
3	Dwelling Exterior Mortar - White * #	<29.1
4	Dwelling Exterior Yellow Brick - White #	<31.1
5	Dwelling Exterior Wood Shingle - White	1,690

6	Dwelling Passage Concrete Step - Red	1,020
7	Tower Exterior Base - Black *	6,050
8	Dwelling 1st Floor Closet Basetrim - White *	2,650
9	Dwelling Kitchen Wainscot - White	9,730
10	Dwelling Bedroom Closet - White	7,880
11	Dwelling Office Base Trim - White	1,890
12	Dwelling Exterior Kitchen Window Sill - White	122,000
13	Dwelling 1st Floor Wood Base Trim on Landing to basement - White	37,600
14	West Dwelling 1st Floor Door Casing Wood *	81,500
15	West Dwelling 1st Floor Closet Door Casing	85,900
16A	West Dwelling Storage Porch Wood Floor - Grey	89,600
16B	West Dwelling Living Room Base Trim - White	26,400
17	West Dwelling 1st Floor North Storage Porch Floor - Grey *	109,000
18	East Dwelling 2nd Floor Electric Closet Wainscot - White	26,000
19	East Dwelling 2nd Floor Electric Closet Door Casing - White *	9,900
20	East Dwelling 2nd Floor Closet Baseboard - White *	1,770
21	East Dwelling 2nd Floor Closet Base Trim - White *	2,340
22	West Dwelling 2nd Floor Closet Wood Base Trim - Grey	32,600
23	West Dwelling 2nd Floor Bedroom Base Trim - White	88,600
24	Tower Ground Floor Window Frame - White	104,000
25	Tower Ground Floor Wall - Grey	98,200
26	Tower Ground Floor Concrete Floor - Grey	704
27	Tower Lantern Deck Wood Panel - White	98,400
28	Tower Lantern Deck Wood Doors - White *	154,000
29	Tower Lantern Deck Metal Jamb Between Interior and Exterior Door - White	117,000
30	Dwelling Exterior Wood Shingle - White	8,560

* Substrate present in paint sample
# Sample results were detected below the reporting limit.

Thank you for the opportunity to assist with this Big Sable Lighthouse project. The work described herein was conducted following practices and principles consistent with the level of care and skill ordinarily exercised by members of this profession currently practicing under similar conditions. Please feel free to contact me if there are any questions.

Sincerely,

R. Robb Cookman

R. Robb Cookman, PE

Attachments: Attachment A - Laboratory Results and Chain-of-Custody.

Analysis Report

Schneider Laboratories Global, Inc

2512 W. Cary Street • Richmond, Virginia • 23220-5117
804-353-6778 • 800-785-LABS (5227) • Fax 804-359-1475

Customer: Sanders & Czapski Associates, PLLC (5376)
Address: 109 S. Front Street
Suite 210
Marquette, MI 49855

Attn:

Project: Big Sable Lighthouse
Location: Ludington, MI
Number:

Order #: 543005

Matrix	Paint
Received	12/09/23
Analyzed	12/12/23
Reported	12/12/23

PO Number:

Sample ID / Parameter	Cust. Sample ID	Location / Method	Sample Date	Weight / Total µg	% / Wt.	Conc.	RL*
543005-001	1	D Ext Brick Red Wht	10/14/23	325 mg			
Lead		EPA 7000B		17.5 µg	0.00538 %	53.8 mg/kg	30.8 mg/kg
543005-002	2	D Ext Brick Yellow Wht	10/14/23	328 mg			
Lead		EPA 7000B		10.0 µg	0.00305 %	30.5 mg/kg	30.5 mg/kg
543005-003	3	D Ext Mortor Wht	10/14/23	344 mg			
Lead		EPA 7000B		<10.0 µg	<0.00291 %	<29.1 mg/kg	29.1 mg/kg
		Sample contains substrate which may affect the calculation of weight percent and mg/kg.					
543005-004	4	D Ext Brick Yellow Wht	10/14/23	322 mg			
Lead		EPA 7000B		<10.0 µg	<0.00311 %	<31.1 mg/kg	31.1 mg/kg
543005-005	5	D Ext W Shingle Wht	10/14/23	331 mg			
Lead		EPA 7000B		561 µg	0.169 %	1690 mg/kg	60.4 mg/kg
543005-006	6	D Passage Conc Step Red	10/14/23	320 mg			
Lead		EPA 7000B		325 µg	0.102 %	1020 mg/kg	31.3 mg/kg
543005-007	7	T Ext Base Bulk	10/14/23	321 mg			
Lead		EPA 7000B		1940 µg	0.605 %	6050 mg/kg	156 mg/kg
		Sample contains substrate which may affect the calculation of weight percent and mg/kg.					
543005-008	8	D 1st Closet Basetrim Wht	10/14/23	314 mg			
Lead		EPA 7000B		833 µg	0.265 %	2650 mg/kg	63.7 mg/kg
		Sample contains substrate which may affect the calculation of weight percent and mg/kg.					
543005-009	9	D Kitchen Wainscat Wht	10/14/23	309 mg			
Lead		EPA 7000B		3010 µg	0.973 %	9730 mg/kg	324 mg/kg
543005-010	10	D BR Closet Wht	10/14/23	344 mg			
Lead		EPA 7000B		2710 µg	0.788 %	7880 mg/kg	291 mg/kg
543005-011	11	D Office Basetrim Wht	10/14/23	310 mg			
Lead		EPA 7000B		587 µg	0.189 %	1890 mg/kg	64.5 mg/kg
543005-012	12	KD Ext Win Sill Wht	10/14/23	319 mg			
Lead		EPA 7000B		39000 µg	12.2 %	122000 mg/kg	3130 mg/kg
543005-013	13	KD 1st FL Doorcasing Wht	10/14/23	331 mg			
Lead		EPA 7000B		12400 µg	3.76 %	37600 mg/kg	1510 mg/kg

Minimum reporting limit: 10.0 µg. All internal QC parameters were met. Unusual sample conditions, if any, are described. Do not reproduce this report except in full. Values are reported to three significant figures. PPM = mg/kg | PPB = µg/kg. The test results apply to the sample as received. AIHA LAP, LLC accredited for Lead (Lab ID 100527).

Analysis Report

Schneider Laboratories Global, Inc

2512 W. Cary Street • Richmond, Virginia • 23220-5117
804-353-6778 • 800-785-LABS (5227) • Fax 804-359-1475

Customer: Sanders & Czapski Associates, PLLC (5376)
Address: 109 S. Front Street
Suite 210
Marquette, MI 49855

Attn:

Project: Big Sable Lighthouse
Location: Ludington, MI
Number:

Order #: 543005

Matrix	Paint
Received	12/09/23
Analyzed	12/12/23
Reported	12/12/23

PO Number:

Sample ID / Parameter	Cust. Sample ID	Location / Method	Sample Date	Weight / Total µg	% / Wt.	Conc.	RL*
543005-014	14	WD 1st FL Doorcasing	10/14/23	252 mg			
Lead		EPA 7000B		20500 µg	8.15 %	81500 mg/kg	1980 mg/kg
		Sample contains substrate which may affect the calculation of weight percent and mg/kg.					
543005-015	15	WS 1st FL Closet Door C	10/14/23	333 mg			
Lead		EPA 7000B		28600 µg	8.59 %	85900 mg/kg	3000 mg/kg
543005-016	16A	WD St Porch Wainscot Wht	10/14/23	342 mg			
Lead		EPA 7000B		30600 µg	8.96 %	89600 mg/kg	2920 mg/kg
543005-017	16B	WD LR Basetrim Wht	10/14/23	329 mg			
Lead		EPA 7000B		8680 µg	2.64 %	26400 mg/kg	760 mg/kg
543005-018	17	WDNSt Porch Wood FL Grey	10/14/23	336 mg			
Lead		EPA 7000B		36800 µg	10.9 %	109000 mg/kg	2980 mg/kg
		Sample contains substrate which may affect the calculation of weight percent and mg/kg.					
543005-019	18	D 2nd FL Elec Closet	10/14/23	257 mg			
Lead		EPA 7000B		6680 µg	2.60 %	26000 mg/kg	973 mg/kg
543005-020	19	D 2nd FL Elec Closet Door	10/14/23	315 mg			
Lead		EPA 7000B		3120 µg	0.990 %	9900 mg/kg	317 mg/kg
		Sample contains substrate which may affect the calculation of weight percent and mg/kg.					
543005-021	20	D 2nd FL Closet Baseboard	10/14/23	292 mg			
Lead		EPA 7000B		516 µg	0.177 %	1770 mg/kg	68.5 mg/kg
		Sample contains substrate which may affect the calculation of weight percent and mg/kg.					
543005-022	21	D 2nd FL Closet Basetrim	10/14/23	314 mg			
Lead		EPA 7000B		736 µg	0.234 %	2340 mg/kg	63.7 mg/kg
		Sample contains substrate which may affect the calculation of weight percent and mg/kg.					
543005-023	22	D 2nd FL Closet Basetrim	10/14/23	266 mg			
Lead		EPA 7000B		8680 µg	3.26 %	32600 mg/kg	940 mg/kg
543005-024	23	D 2nd FL Bedrm Basetrim	10/14/23	346 mg			
Lead		EPA 7000B		30600 µg	8.86 %	88600 mg/kg	2890 mg/kg
543005-025	24	T GrFL Win Frame Wht	10/14/23	333 mg			
Lead		EPA 7000B		34600 µg	10.4 %	104000 mg/kg	3000 mg/kg

Minimum reporting limit: 10.0 µg. All internal QC parameters were met. Unusual sample conditions, if any, are described. Do not reproduce this report except in full. Values are reported to three significant figures. PPM = mg/kg | PPB = µg/kg. The test results apply to the sample as received. AIHA LAP, LLC accredited for Lead (Lab ID 100527).

Analysis Report

Schneider Laboratories Global, Inc

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804-353-6778 • 800-785-LABS (5227) • Fax 804-359-1475

Customer: Sanders & Czapski Associates, PLLC (5376)
Address: 109 S. Front Street
Suite 210
Marquette, MI 49855

Attn:

Project: Big Sable Lighthouse
Location: Ludington, MI
Number:

Order #: 543005

Matrix Paint
Received 12/09/23
Analyzed 12/12/23
Reported 12/12/23

PO Number:

Sample ID / Parameter	Cust. Sample ID	Location / Method	Sample Date	Weight / Total µg	% / Wt.	Conc.	RL*
543005-026	25	T GrFL Wall Grey	10/14/23	333 mg			
Lead		EPA 7000B		32700 µg	9.82 %	98200 mg/kg	3000 mg/kg
543005-027	26	T GrFL Conc Floor Grey	10/14/23	308 mg			
Lead		EPA 7000B		217 µg	0.0704 %	704 mg/kg	32.5 mg/kg
543005-028	27	T Lant Deck Woon Panel	10/14/23	336 mg			
Lead		EPA 7000B		33100 µg	9.84 %	98400 mg/kg	2980 mg/kg
543005-029	28	T Lant Deck Wood Door Wht	10/14/23	240 mg			
Lead		EPA 7000B		37000 µg	15.4 %	154000 mg/kg	4170 mg/kg
		Sample contains substrate which may affect the calculation of weight percent and mg/kg.					
543005-030	29	T Lant Deck Metal Jamb Wh	10/14/23	325 mg			
Lead		EPA 7000B		37900 µg	11.7 %	117000 mg/kg	3080 mg/kg
543005-031	30	D Ext Wood Shingle Wht	10/14/23	334 mg			
Lead		EPA 7000B		2860 µg	0.856 %	8560 mg/kg	299 mg/kg

Analyst: SA
543005-12/12/23 03:08 PM

Reviewed By: **Ahmed Elnasseh**
Analyst

Federal Lead Paint Statute as of 12/1/2023

Location	Level	Unit
Lead in paint by wt.	0.50	%
Lead in paint PPM	5000	mg/kg

Minimum reporting limit: 10.0 µg. All internal QC parameters were met. Unusual sample conditions, if any, are described. Do not reproduce this report except in full. Values are reported to three significant figures. PPM = mg/kg | PPB = µg/kg. The test results apply to the sample as received. AIHA LAP, LLC accredited for Lead (Lab ID 100527).

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S 31
543005
V:\543\543005
dcheatham 12/9/2023 2:01:38 PM
U.S. Mail N/A

Submitting Co.	Sanders & Czapski Associates PC	State of Collection	Michigan	Cert. Required	☒ YES ☐ NO
109 S. Front street		Acct #	5376	Phone	906 250 1593
Marquette, MI 49855		Email	robbcookman@gmail.com Ken@sanders-Czapski.com		
Project Name	Big Sable Lighthouse	PO #			
Project Location	Ludington, MI	Special Instructions: STD TAT Lead by FLAA EPA 7000B			
Project Number					
Collected By	Ken Czapski				

Turn Around Time **
- ☐ 2 Hour *
- ☐ Same day *
- ☐ 1 business day
- ☐ 2 business days
- ☐ 3 business days
- ☒ 5 business days STD

* not available for all tests
** past 3 PM the TAT will begin next business day
Please schedule rush tests in advance

Matrix
- ☐ Air
- ☒ Paint
- ☐ Wipe
- ☐ Bulk
- ☐ Waste Water
- ☐ Ground Water
- ☐ Drinking Water
- ☐ TSP / PM10
- ☐ _____

Tests/Analytes (Select ALL that Apply) Blank spaces are for additional analytes

Asbestos in Bulk
- ☐ PLM
- ☐ PLM Qualitative
- ☐ 400 Point Count
- ☐ 1000 Point Count
- ☐ Gravimetric Prep

Asbestos in Air
- ☐ PCM
- ☐ PCM-B Rules

Metals Total
- ☒ Lead EPA 7020B
- ☐ RCRA 8 Metals
- ☐ Chromium VI
- ☐ Mercury
- ☐ _____

Gravimetric
- ☐ Total Dust NIOSH 0500
- ☐ Resp. Dust NIOSH 0600

TCLP
- ☐ Lead
- ☐ RCRA 8 Metals
- ☐ Full TCLP (w/ organics 10 Day)

Miscellaneous
- ☐ Silica FTIR (7602)
- ☐ _____

Microbiology
- ☐ BACT (MPN/PA)
- ☐ Mold Direct Exam
- ☐ Allergens

Sub-Contract
- ☐ TEM Chatfield
- ☐ TEM AHERA
- ☐ TEM 7402
- ☐ Silica XRD (7500)

Sample #	Date Sampled	Time Sampled	Sample Identification (Employee, Bldg, Material, Type[2])	Wipe Area	Time[2] Start	Time[2] Stop	Flow Rate[3] Start	Flow Rate[3] Stop	Total Air[4]
1	10/14/23		D Ext. Brick Red-white						
2			D Ext. Brick Yellow-white						
3			D Ext. Mortar - white						
4			D Ext. Brick Yellow - white						
5			D Ext. W. Shingle - white						
6			D Passage Conc. Step - Red						
7			T Ext Base - BLK						
8			D 1st Closet basetrim - white						
9			D Kitch Wainscot - white						
10			D BR closet - white						

For Aqueous and Solid samples ensure enough sample is sent for duplicate and spike analysis
[1]Type: A=Area, B=Blank, P=Personal, E=Excursion [2]Beginning/End of Sample Period [3]Liters/Minute [4]Volume in Liters [time in min × flow in L/min]

Relinquished By: RobbCookman Signature: RobbCookman Date/Time 12/5/2023

! ALL SHADED FIELDS MUST BE FILLED TO AVOID DELAYS !

Chain-of-Custody documentation continued internally

SCHNEIDER LABORATORIES GLOBAL, INC.
2512 West Cary Street, Richmond, Virginia 23220-5117
804-353-6778 • 800-785-LABS (5227) • Fax 804-359-1475
www.slabinc.com • info@slabinc.com

Submitting Co.	Sanders & Czapski Assoc. PLLC	State of Collection	Michigan	Cert Required	☒ YES ☐ NO
109 S. Front Street		Acct #	5376	Phone	906 250 1593
Marquette, MI 49855		Email	robbCookman@gmail.com		
Project Name	Big Sable Lighthouse	PO #	fken@sanders-czapski.com		
Project Location	Ludington, MI	Special Instructions:	STD TAT lead by FLAA EPA 7000B		
Project Number					
Collected By	Ken Czapski				

Turn Around Time *
- ☐ 2 Hour *
- ☐ Same day *
- ☐ 1 business day
- ☐ 2 business days
- ☐ 3 business days
- ☒ 5 business days STD

* not available for all tests
** past 3 PM the TAT will begin next business day
Please schedule rush tests in advance

Matrix
- ☐ Air
- ☒ Paint
- ☐ Soil
- ☐ Wipe
- ☐ Bulk
- ☐ Waste Water
- ☐ Ground Water
- ☐ Drinking Water
- ☐ TSP / PM10
- ☐ _____

Tests/Analytes (Select ALL that Apply) Blank spaces are for additional analytes

Asbestos in Bulk
- ☐ PLM
- ☐ PLM Qualitative
- ☐ 400 Point Count
- ☐ 1000 Point Count
- ☐ Gravimetric Prep

Asbestos in Air
- ☐ PCM
- ☐ PCM-B Rules

Metals Total
- ☒ Lead EPA 7000B
- ☐ RCRA 8 Metals
- ☐ Chromium VI
- ☐ Mercury
- ☐ _____

Gravimetric
- ☐ Total Dust NIOSH 0500
- ☐ Resp. Dust NIOSH 0600

TCLP
- ☐ Lead
- ☐ RCRA 8 Metals
- ☐ Full TCLP (w/ organics 10 Day)

Miscellaneous
- ☐ Silica FTIR (7602)
- ☐ _____

Microbiology
- ☐ BACT (MPN/PA)
- ☐ Mold Direct Exam
- ☐ Allergens

Sub-Contract
- ☐ TEM Chatfield
- ☐ TEM AHERA
- ☐ TEM 7402
- ☐ Silica XRD (7500)

Sample #	Date Sampled	Time Sampled	Sample Identification (Employee, Bldg,Material, Type[1])	Wipe Area	Time[2] Start	Time[2] Stop	Flow Rate[3] Start	Flow Rate[3] Stop	Total Air[4]
11	10/4/23		D Office Baseboard - white						
12	"		KD Ext. Win Sill - white						
13	"		KD 1st Fl Baseboard - white						
14	"		WD 1st Fl Door Casing white						
15	"		WD 1st Fl Clst Door Casing - white						
16A	"		WD St Porch Wainscot - White						
16B	"		WD LR Baseboard white						
17	"		WD NSt. Porch Wood Floor - Grey						
18	"		D 2nd FL Elec Closet Wainscot - white						
19	↓		D 2nd FL Elec Closet Door Casing white						

For Aqueous and Solid samples ensure enough sample is sent for duplicate and spike analysis
[1]Type: A=Area, B=Blank, P=Personal, E=Excursion [2]Beginning/End of Sample Period [3]Liters/Minute [4]Volume in Liters [time in min × flow in L/min]

Relinquished By: Robb Cookman Signature: Robb Cookman Date/Time 12/5/2023

ALL SHADED FIELDS MUST BE FILLED TO AVOID DELAYS

Chain-of-Custody documentation continued internally

SCHNEIDER LABORATORIES GLOBAL, INC.

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www.slabinc.com • info@slabinc.com

Submitting Co.	Sanders & Czapski Assoc. PLLC	State of Collection	Michigan	Cert. Required	☒ YES ☐ NO
109 S. Front Street		Acct #	5376	Phone	906 250 1593
Marquette, MI 49855		Email	robbCookman@gmail.com		
Project Name	Big Sable Lighthouse	PO #	fken@sanders-czapski.com		
Project Location	Ludington, MI	Special Instructions:	STD TAT lead by FLAA EPA 7000B		
Project Number					
Collected By	Ken Czapski				

Turn Around Time	Matrix	Tests/Analytes (Select ALL that Apply) - Blank spaces are for additional analytes			
☐ 2 Hour *	☐ Air	**Asbestos in Bulk**	**Metals Total**	**TCLP**	**Microbiology**
☐ Same day *	☒ Paint	☐ PLM	☒ Lead EPA 7000B	☐ Lead	☐ BACT (MPN/PA)
☐ 1 business day	☐ Soil	☐ PLM Qualitative	☐ RCRA 8 Metals	☐ RCRA 8 Metals	☐ Mold Direct Exam
☐ 2 business days	☐ Wipe	☐ 400 Point Count	☐ Chromium VI	☐ Full TCLP (w/ organics 10 Day)	☐ Allergens
☐ 3 business days	☐ Bulk	☐ 1000 Point Count	☐ Mercury		**Sub-Contract**
☒ 5 business days STD	☐ Waste Water	☐ Gravimetric Prep	☐ _____		☐ TEM Chatfield
* not available for all tests	☐ Ground Water	**Asbestos in Air**	**Gravimetric**	**Miscellaneous**	☐ TEM AHERA
** past 3 PM the TAT will begin next business day	☐ Drinking Water	☐ PCM	☐ Total Dust NIOSH 0500	☐ Silica FTIR (7602)	☐ TEM 7402
Please schedule rush tests in advance	☐ TSP / PM10	☐ PCM-B Rules	☐ Resp. Dust NIOSH 0600	☐ _____	☐ Silica XRD (7500)
	☐ _____				

Sample #	Date Sampled	Time Sampled	Sample Identification (Employee, Bldg, Material, Type[1])	Wipe Area	Time[2] Start	Time[2] Stop	Flow Rate[3] Start	Flow Rate[3] Stop	Total Air[4]
20	10/14/23		D 2nd Fl Closet Baseboard - White						
21	10/14/23		D 2nd Fl Closet Base trim White						
22	10/14/23		D 2nd Fl closet Base trim Grey						
23	10/14/23		D 2nd Fl Bj Rm Base trim - White						
24	10/14/23		T Gr. Flr Win. Frame - White						
25			T Gr Fl Wall - Grey						
26			T Gr Fl Concrete Floor - Grey						
27			T Lant Deck wood Panel white						
28			T Lant Deck Deck Wood Doors white						
29	↓		T Lant Deck Metal Jamb White						

For Aqueous and Solid samples ensure enough sample is sent for duplicate and spike analysis

[1]Type: A=Area, B=Blank, P=Personal, E=Excursion [2]Beginning/End of Sample Period [3]Liters/Minute [4]Volume in Liters (time in min × flow in L/min)

Relinquished By: Robb Cookman Signature: Robb Cookman Date/Time 12/5/2023

ALL SHADED FIELDS MUST BE FILLED TO AVOID DELAYS

Chain-of-Custody documentation continued internally

Project Location	Ludington, MI	Special Instructions:	STD TAT lead by FLAA EPA 7000B

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www.slabinc.com • info@slabinc.com

Submitting Co.	Sanders & Czapski Assoc. PLLC	State of Collection	Michigan	Cert. Required	☒ YES ☐ NO
109 S. Front Street		Acct #	5376	Phone	906 250 1593
Marquette, MI 49855		Email	robbCookman@gmail.com		
Project Name	Big Sable Lighthouse	PO #	tken@sanders-czapski.com		
Project Location	Ludington, MI	Special Instructions:	STD TAT lead by FLAA EPA 7000B		
Project Number					
Collected By	Ken Czapski				

Turn Around Time **
- ☐ 2 Hour *
- ☐ Same day *
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* not available for all tests
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Matrix
- ☐ Air
- ☒ Paint
- ☐ Soil
- ☐ Wipe
- ☐ Bulk
- ☐ Waste Water
- ☐ Ground Water
- ☐ Drinking Water
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- ☐ _____

Tests/Analytes (Select ALL that Apply) Blank spaces are for additional analytes

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- ☐ Gravimetric Prep

Asbestos in Air
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Metals Total
- ☒ Lead EPA 7000B
- ☐ RCRA 8 Metals
- ☐ Chromium VI
- ☐ Mercury
- ☐ _____

Gravimetric
- ☐ Total Dust NIOSH 0500
- ☐ Resp. Dust NIOSH 0600

TCLP
- ☐ Lead
- ☐ RCRA 8 Metals
- ☐ Full TCLP (w/ organics 10 Day)

Miscellaneous
- ☐ Silica FTIR (7602)
- ☐ _____

Microbiology
- ☐ BACT (MPN/PA)
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- ☐ Allergens

Sub-Contract
- ☐ TEM Chatfield
- ☐ TEM AHERA
- ☐ TEM 7402
- ☐ Silica XRD (7500)

Sample #	Date Sampled	Time Sampled	Sample Identification (Employee, Bldg, Material, Type[1])	Wipe Area	Time[2] Start	Time[2] Stop	Flow Rate[3] Start	Flow Rate[3] Stop	Total Air[4]
30	10/14/23		D Ext wood shingle	white					

For Aqueous and Solid samples ensure enough sample is sent for duplicate and spike analysis

[1]Type: A=Area, B=Blank, P=Personal, E=Excursion [2]Beginning/End of Sample Period [3]Liters/Minute [4]Volume in Liters [time in min × flow in L/min]

Relinquished By: Robb CooKman Signature: Robb Cookman Date/Time 12/5/2023

! ALL SHADED FIELDS MUST BE FILLED TO AVOID DELAYS !

Chain-of-Custody documentation continued internally