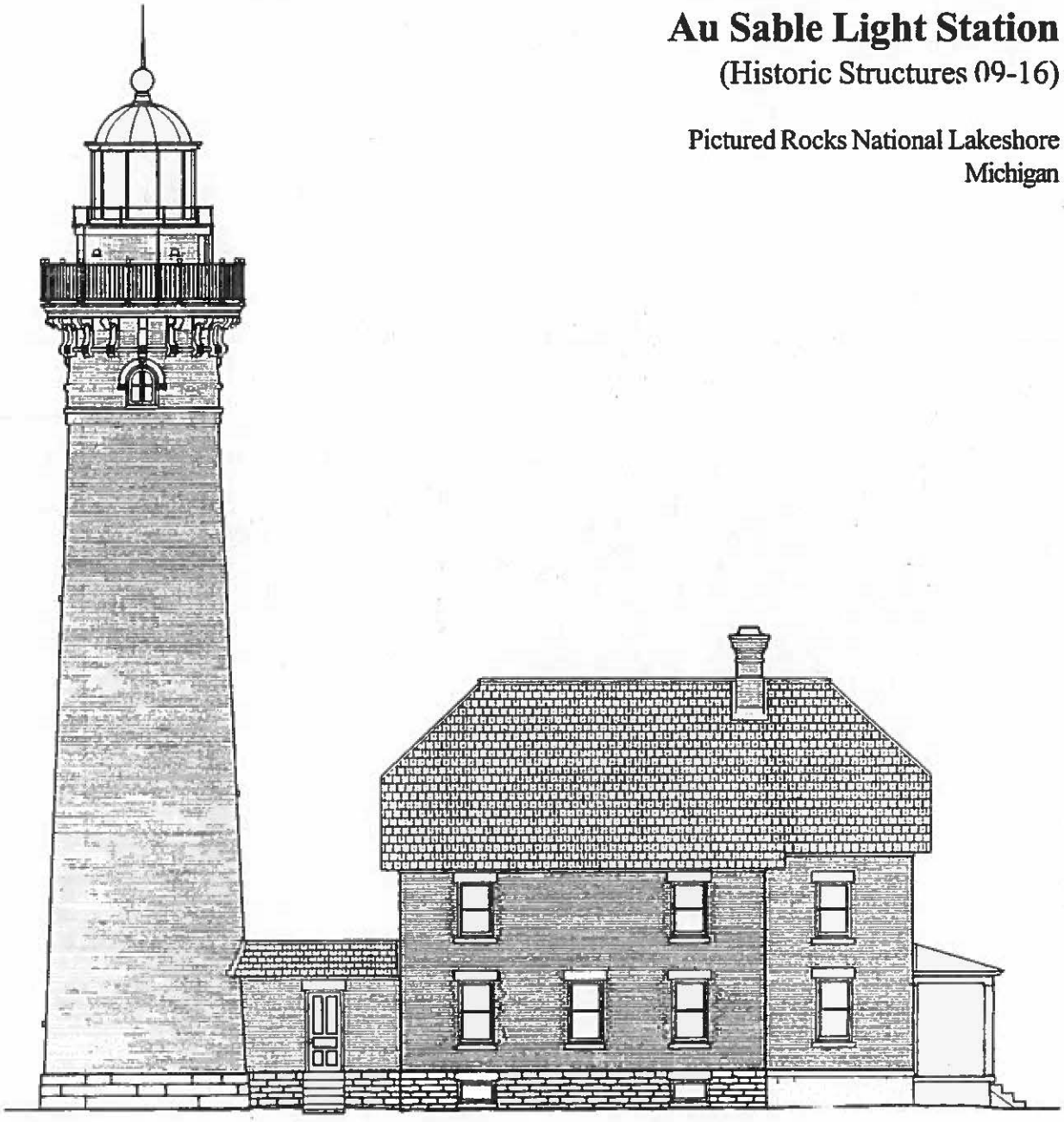
HISTORIC STRUCTURE REPORT

Au Sable Light Station

(Historic Structures 09-16)

Pictured Rocks National Lakeshore
Michigan



January 2000
Final Report

QUINN EVANS | ARCHITECTS

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Au Sable Light Station

(HS 09-17)

Prepared by

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Part A: Introduction

Statement of Significance

Pictured Rocks National Lakeshore extends approximately 35 miles along the southeastern shore of Lake Superior in the north-central section of the Upper Peninsula of Michigan. Pictured Rocks was recognized as a potential outstanding public recreation site at least as far back as 1924, when the Michigan Conservation Commission acted to designate the area as a state park. As with so many conservation projects, lack of funding prevented acquisition of important acreage.[1] Several years later, in 1957-58, the National Park Service again identified Pictured Rocks as one of five areas along the Great Lakes shoreline that contained features of national significance.[2] Following several studies and unsuccessful legislative attempts to create the national lakeshore, it was finally established by the 89th Congress on October 15, 1966, to "preserve for the benefit, inspiration, education, recreational use, and enjoyment of the public, a significant portion of the diminishing shoreline of the United States and its related geographic and scientific features..."[3] However, the Lakeshore was not formally established until October 1972.

To guide the current as well as future supervision of the park's land and water, the National Park Service prepared a General Management Plan which divided the park into three zones: a natural zone, to preserve the park's scenery and outstanding natural features; a park development zone, to stabilize and protect the park's character and land uses; and a historic zone, to preserve, protect and interpret the park's historic structures. By dividing the park into these three zones, the Lake Superior shoreline and inland lakes would be preserved, the watersheds and streams protected, selective logging on a sustained yield basis could be permitted, and historic structures could be stabilized and restored.

The light station at Point Au Sable is an important historical feature within the historic zone of the park that showcases an era of early Great Lakes shipping and navigation, and the subsequent impact of technology on both. The Au Sable Light Station (originally called the Big Sable Light Station) was established in 1873 to guide ships along the southern coast of Lake Superior. Prior to its construction, there was an 80 mile stretch of unlit shoreline between the lighthouse at Whitefish Point to the east and Grand Island to the west. This stretch of shore, which was along the shortest route to the western ports of Lake Superior, was also the most treacherous. The dangerous offshore reefs and shoals caused many fatal shipwrecks, and led the area to become known as the "Graveyard Coast."

Today, the Au Sable Light Station, as well as lighthouses in general, stand as a testament to a once utilitarian, but very important, profession which no longer exists in the United States. The employees of the Lighthouse Service, now thought of as romantic individualists, were men (and sometimes women) who toiled day and night to provide safety to those on the "inland seas." The duties of the lightkeeper and his assistants were many. As David A. Clary notes:

> Far from the image of the sedentary philosopher who had only to watch the waves and ships go by, lighting his lamp once each evening, the keeper was a mechanic, carpenter, painter, gardener, and roustabout who labored, often around the clock, seven days a week. The keeper was also an administrator, chief of his station. He managed his accounts and the public property in his care, supervised one or more assistants, and kept his records religiously.[4]

With its proximity to camping facilities, and its location along a well traveled foot trail along the Lake Superior shore within the Pictured Rocks National Lakeshore, the historically significant Au Sable Light Station attracts a significant number of visitors. The complex provides a general understanding of the important role that lighthouses and their keepers once had in guiding ships safely along the southern shore of Lake Superior, which was a significant shipping path of the 19th and early 20th centuries.

The Au Sable Light Station was added to the National Register of Historic Places in October 1978. The entire complex was also placed on the National Park Service's List of Classified Structures (LCS). All of the structures are listed as National Park Service Management Category "A", or those structures which "must be preserved and maintained." Projects (maintenance, construction, etc.) affecting the site must comply with "Procedures for the Protection of Historic and Cultural Environment" (36 CFR Part 800) established by the Advisory Council on Historic Preservation in accordance with Section 106 of the National Historic Preservation Act of 1966 and Sections 1(3) and 2(b) of Executive Order 11593. The following structures are affected:

Keeper's Residence	HS-09
Light Tower	HS-10

Part B:

Historic Documentation Summary

Part B: Historic Documentation Summary

Historic Significance

History of the Site

Lake Superior was the second of the Great Lakes to be explored by the Europeans after Lake Huron. The first white men to explore Lake Superior were two French explorers, Etienne Brulé, and a man by the name of Grenoble.[1] It is believed that in 1662 Brulé may have explored Lake Superior's south shore as far as Point Au Sable. Almost thirty years later, in 1658, two other Frenchmen, Pierre Esprit Radisson and his brother-in-law, Medard Chouart, Sieur des Groseilliers, also explored the south shore, stopping at the nearby Grand Sable Dunes in the summer of that year. Radisson wrote in his journal that the area "...is most dangerous when there is any storms."[2]

"Au Sable" takes its name from the Grand Sable Dunes which flank the point to the east. As was common, early French explorers adopted the Native Americans' names for various areas. In the case of Au Sable and the Grand Sable Dunes, the French adopted the Ojibwa name for the area, Gitchee Nagow or "Great Sands," calling it "Les Grandes Sables." Cornelli, for example, listed Les Grandes Sables when he placed the site on his 1680 maps, *Partie Occidentable du Canada ou dela Novelle France*.[3] Variations (all based on the presence of the sand dunes) on the area's name continued. Henry R. Schoolcraft systematically explored the south shore of Lake Superior in 1820 and did extensive work on Ojibwa Indian ethnology, documenting that the Ojibwa name for the dunes was Gitchee Nagow or "Great Sands." Schoolcraft himself called it "La Pointe La Grand Sable" while U.S. Indian Agent Thomas L. McKenney called it "La Point du Grand Sables," and Charles Lanman, otherwise known as Dr. Chandler Robbins Gilman, referred to it as "Point Aux Sables." Ultimately, the point came to be known simply as "Au Sable."

The introduction of steamships on the Great Lakes occurred in 1818 and the Erie Canal opened in 1825, connecting the Great Lakes with the Atlantic seaboard. Initially, these events had little effect on the lakes. However, travel on the lakes and colonization of areas surrounding the lakes began to steadily increase, particularly after the introduction of regular steamboat traffic in the 1830s. Soon, innumerable settlers and immigrants were moving west on the lakes' waters via wood-burning steamships. This movement was enhanced after the introduction of the first steamboat on Lake Superior in 1841. The completion of construction of the locks on the St. Mary's River at Sault Ste. Marie in 1855 made Lake Superior accessible to ships from around the world.

It did not take long after the introduction of steamships on the Great Lakes for Lake Superior's abundant natural resources to be discovered by American and European settlers. An initial copper rush in 1843-45 drew hundreds of speculators. Soon thereafter, the "mining companies gradually discovered and developed the copper deposits."[4] The discovery of iron ore in the region also occurred about this time. Once this happened the "volume of iron ore produced near Lake Superior and shipped over its surface grew enormously, as evidenced by the numbers of vessels plying the lake. The canal at Sault Ste. Marie recorded 193 ship passages in 1855, about 5,400 in 1885, and nearly 18,000 a decade later."[5] Furthermore, "by the 1880s, Michigan was supplying about 40 percent of American iron ore output and half of the nation's copper."[6]

Because of the thousands of ships plying Lake Superior, and their tendency to hug the southern coastline for protection from the often virulent weather, shipwrecks frequently occurred. As a result, the coastline became known as the "graveyard coast." Not surprisingly, lighthouses began to be built to enhance navigational safety in the area. By 1868 fourteen had been built on the lake, including one at Whitefish Point and one at Grand Island Harbor. However, between these two lighthouses, a distance of eighty miles, there were no lights to guide mariners safely through this treacherous stretch. In 1872, Congress appropriated federal funds and acquired land for the construction of a lighthouse at Point Au Sable, located along this hazardous stretch twelve miles west of Grand Marais. Construction was completed and the light became operational in 1874. By providing a much needed navigational aid, the Au Sable Light Station not only helped save lives, but also helped further the goals of industry and commerce of the Great Lakes Region.[7] It played a critical role, particularly during the years 1895-1907, when shipping from Grand Marais was at its peak.

The lighthouse complex was unmanned by the U.S. Coast Guard in 1958. It was "at that time [that] an automatic bulb changer was placed on the outside of the tower and a bell buoy off shore near the shoal areas."[8] Also at this time, the National Park Service completed a Great Lakes shoreline recreation area survey, and

identified the Pictured Rocks area as "one of five areas that contained features of national significance [including the Au Sable Light Station]," and was recommended for "consideration as an addition to the National Park System..."[9] Various attempts to establish the national lakeshore were unsuccessful, however, until October 15, 1966, when Congress passed Public Law 89-668 defining the lakeshore in order that it be preserved for future generations. The lakeshore was formally established in October 1972. The United States Coast Guard continues to operate the automated light to this day, as a navigational beacon for recreational and commercial lake traffic.

In September 1981, a General Management Plan for the lakeshore was completed by the National Park Service. Management zoning was utilized to guide the future supervision of the lakeshore's lands and waters. Toward this goal, three zones were identified - natural, historic, and park development - in order to "set forth major differences in management emphasis for lands and waters under sole or primary jurisdiction of the National Park Service."[10] The Au Sable Light Station is one of several historically significant cultural resources that comprise the historic zone. Within this zone it has been decided that, "Management emphasis will be on [the] preservation, protection, and interpretation of these resources and their settings and on appropriate adaptive use of these structures."[11] More specifically, the General Management Plan states that, "The Au Sable Point Light Station complex will be restored and stabilized to protect and enhance these historically significant structures."[12] Furthermore, it was determined that "the light station complex will be the focus for maritime interpretation."[13] This decision was based on a survey, conducted in the summer of 1978 by the National Park Service Harpers Ferry Service Center, of the Great Lakes lighthouses and lifesaving stations. The report "indicates that the Au Sable complex should have first priority for development; it is the most accessible of the National Park Service Great Lakes lighthouses and is an excellent example of a complete complex."[14]

Lighthouse Development

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

For several years, after its initial creation, the growth and administration of the Lighthouse Service was fraught with political and administrative corruption. In 1852, a nine-member Lighthouse Board was appointed in an attempt to alleviate this corruption and maximize the efficiency of the agency. The Board eventually divided the country into twelve regional districts within the Lighthouse Service, with an inspector in charge of each district and depots established as supply centers for each of the district's lighthouses. The lighthouses of Lake Superior, Lake Michigan, and Lake Huron all initially comprised the eleventh district, which was headquartered and serviced by a main depot in Detroit and secondary depots around the district. In 1886 Congress increased the number of districts to sixteen. Under this new organizational scheme, the Great Lakes were divided into three light districts; Lake Superior remained in the Eleventh District.[15]

The Lighthouse Board retained the district inspectors that were already in place prior to the creation of the Board and expanded their numbers in proportion to the increased number of districts. The inspectors "supervised the keepers within their districts, enforcing the rules and regulations passed by the U.S. Lighthouse Board."[16] Inspectors "kept a tight rein on lightkeepers to make sure the existent lights stayed in working order and recommended the installation of new facilities where needed."[17] The district inspector was generally a naval officer and was responsible for the administration, personnel, and inspection of the light stations.

One change that the Board undertook, because of technological advances and the increasing number of light stations, was the assignment of an engineer to each district who was with the U.S. Army Corps of Engineers. The engineers were responsible for the actual repairs, rehabilitation, and construction of the light stations. Initially, they were responsible for producing, providing, and utilizing standard designs for the lighthouses only, but later were assigned responsibility for the outbuildings at the stations as well. The demand and need for new lighthouses was so great that it was virtually impossible to individually design each structure. De-

spite the use of standard designs, however, minor details were often added to the structures to give them a semblance of individuality, such as date stones, and/or additional windows or doors. This was predicated on the availability of materials and labor, however.

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

Another change which the Lighthouse Board mandated was the installation of Fresnel lenses in all of the light stations in the country after 1852. These lenses, which had long been in use in Europe and were known to provide better illumination than those used in the U.S., were gradually acquired for and installed in all U.S. lighthouses. District engineers were responsible for determining the size of the lens each station within their jurisdiction would receive. This was decided according to the location of the station and the intensity of light needed. Once this decision was made, the engineer then prepared specification drawings for the installation of the lenses. With the installation of Fresnel lenses in all of the light stations across the country, as well as general station overhauls, the Lighthouse Service became one of the leading navigational aid systems in the world.

Soon after the Lighthouse Board instituted its changes and the construction of the locks on the St. Mary's River at Sault Ste. Marie in 1855 was completed, Lake Superior became accessible to ships from around the world. Until "the onset of the Civil War in 1861, the Great Lakes region enjoyed an enormous growth of population and trade...Farm products, lumber, and coal went from west to east, while manufactured goods and immigrants moved in the opposite direction."[18]

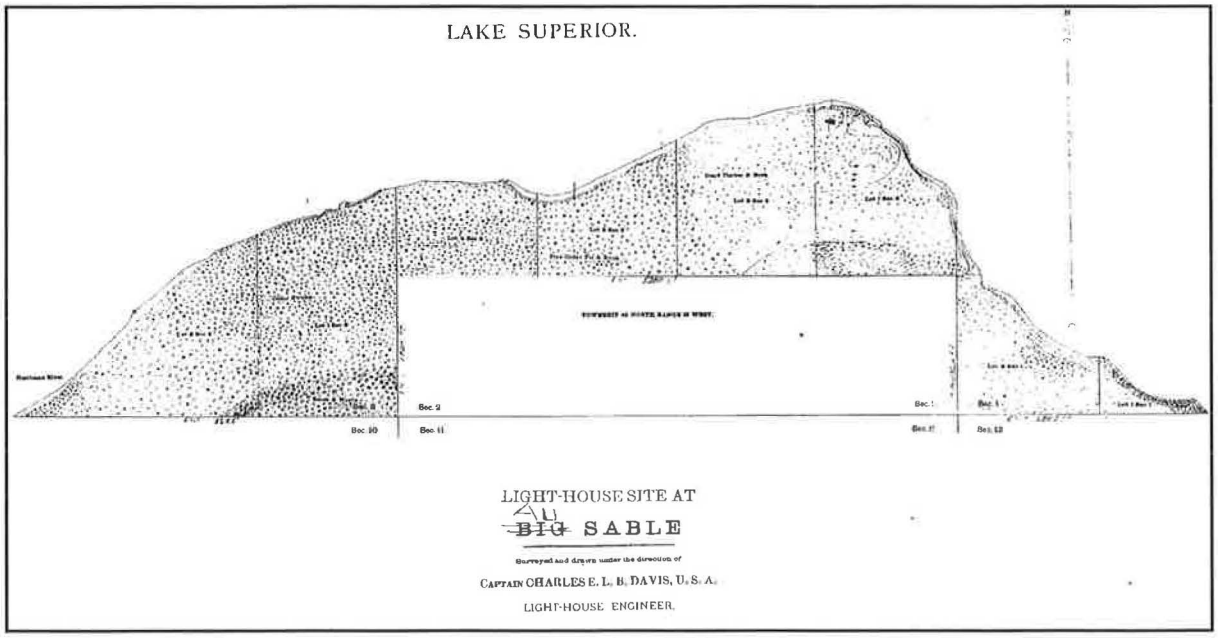
With hundreds, if not thousands of boats plying the southern shore of Lake Superior, the need for lighthouses was great. By 1868, several lighthouses had been built on Lake Superior, including one at Whitefish Point and one at Grand Island Harbor. However, between these two lighthouses, which was a distance of eighty miles, there were no lights to guide mariners through what was a treacherous stretch of irregular coast, numerous islands, reefs, and shoals. A newspaper article in 1871 said that "In all navigation of Lake Superior, there is none more dreaded by the mariner than that from Whitefish Point to Grand Island."[19] Added to these obstacles was the ever-present danger of frequent storms and heavy fog. Vessels often hugged the coastline for protection and, as a result, there were frequent shipwrecks. Because of the often tragic nature of the shipwrecks, the south shore came to be known as the "graveyard coast." Obviously concerned, local ship and boat owners and operators lobbied extensively for another light between the two points. The U.S. Lighthouse Board, once made aware of the problem, was also alarmed by the danger posed. This is evidenced in its Annual Report of 1867 which noted that:

> The distance between White Fish Point and Grand Island harbor is about eighty miles, at present unmarked by a light. Vessels always follow the south shore except in a few remarkable cases, and the absence of a light for this very considerable distance has been seriously felt.[20]

The eleventh lighthouse district was also very concerned and strongly recommended that a lighthouse be established. Finally, in 1872, Congress appropriated $40,000 for the construction of a lighthouse at Point Au Sable. The State of Michigan deeded a parcel of 325.93 acres on September 6, 1872 to the United States for the purposes of building the Au Sable Lighthouse, originally called Big Sable. Located on the south shore of Lake Superior, the legal description of the land is Lots 1 and 2 in Section 1, Lot 1, 2, 3, and 4 in Section 2, and Lots 1 and 2 in Section 3, Township 49 Lots 1 and 2 in Section 3, Township 49 North Range 15 West. The parcel is situated half way between the City of Marquette on the west and Whitefish Point on the east, with the nearest town being Grand Marais. At the time the parcel was deeded, the only access to and from Grand Marais was either by water, a twelve-mile walk along the shore, or overland by foot through a dense forest.[21] Grand Marais, in 1872, was a small town, and offered few amenities. It was "one of the Upper Peninsula's most isolated communities."[22]

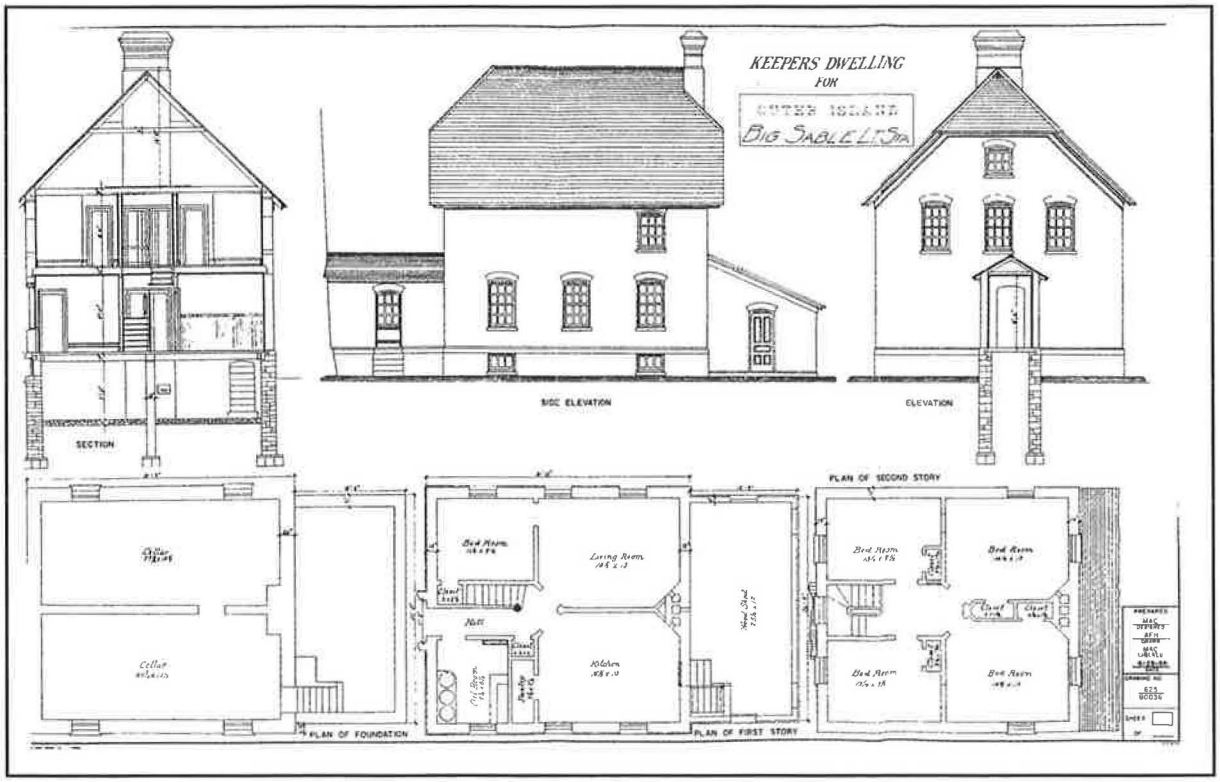
In the spring of 1873, work began on the lighthouse and the auxiliary buildings on the northern tip of Point Au Sable. It wasn't until August 19, 1874, however, that the first beam of light shined from the Au Sable Light Station over the waters of Lake Superior. The lightkeeper's dwelling, as originally built, was a two-story brick building that was attached to a conical brick light tower via a brick passageway, as seen in **Figure 2**.

Figure 1



Survey map of the "Light-House Site at Big Sable", 1884.

Figure 2



Tracing of a U.S. Lighthouse Service drawing depicting the original keeper's dwelling and attached passageway constructed at the Au Sable Light Station and the Outer Island Light Station, both on Lake Superior. Undated.

Around 1897, the U.S. Life Saving Service built a telephone line linking Au Sable, Grand Marais and the stations east to Whitefish Point. Also, at about the same time, Grand Marais "experienced considerable growth as the lumber industry expanded and a railroad was built to the harbor from the south... A few of the earlier keepers apparently stayed at the light year-round, but later they usually spent winters in Grand Marais."[23] In 1905 a road was cut through the forest from Grand Marais to a log slide on Lake Superior east of the lighthouse. Construction "was probably spurred by area logging operations which sent logs down the now-famous Slide located a mile east of the lighthouse, to be rafted to mills in Grand Marais."[24]

In 1909, the keeper's dwelling was enlarged to accommodate two assistant keepers and their families while a second keeper's dwelling was added to the station at the same time to house the head keeper and his family. In 1910, the name of the light station was officially changed from Big Sable to Au Sable. It is also during this year that Congress eliminated the Lighthouse Board and placed the Lighthouse Service under the new Bureau of Lighthouses established by the Department of Commerce, and iron ore "became the single most important cargo, accounting for half the 1910 tonnage...The iron mines of the Lake Superior region produced three-quarters of American ore in the early part of the twentieth century and virtually the entire output was moved by water to major iron and steel plants..."[25]

Slowly, twentieth century progress began to impact the Au Sable Light Station. The road was extended to the lighthouse in 1938 - 1939, and motor vehicles were acquired, making daily drives to Grand Marais both feasible and commonplace. Also during this year, electricity was introduced to the station, powering both the fog signal and the light, relieving the lighthouse crew of a great deal of their daily responsibilities. Additionally, the crew's quarters were electrified and other modernizations undertaken. Eventually, however, modernization "not only improved life for lighthouse personnel, but it caused [the] closing of the facility itself. In 1958, as a way to realize a reported $20,000 annual savings, the Au Sable light was automated and a bell buoy was positioned on the reef."[26]

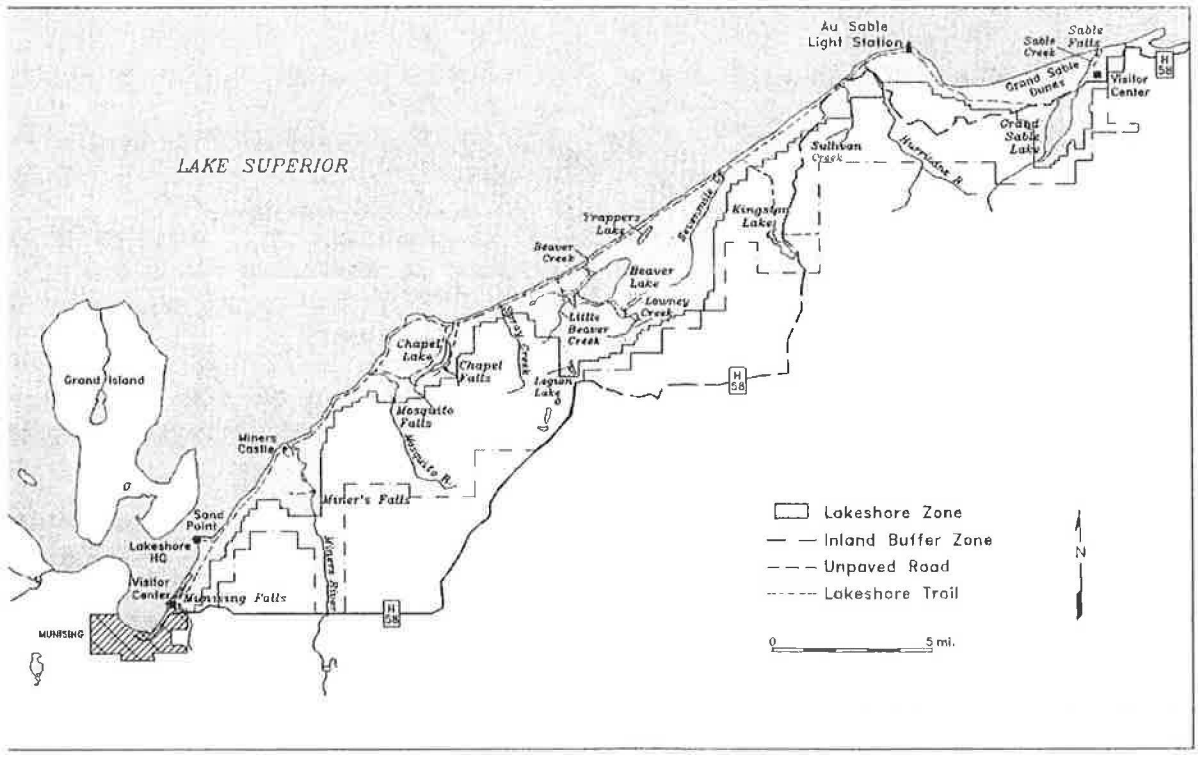
On October 15, 1966, Pictured Rocks National Lakeshore, located in the north-central section of the Upper Peninsula of Michigan along the southern shore of Lake Superior, was established by the 89th Congress of the United States. The legislation defined three zones which would each have its own emphasis within the Lakeshore. The shoreline zone, encompassing 33,550 acres, was established primarily to preserve the Lakeshore's scenery and outstanding natural features. The inland buffer zone, encompassing 37,850 acres, was established to stabilize and protect the Lakeshore's character and land uses as they existed in 1964. The historic zone, spread throughout the Lakeshore, was established to preserve, protect, and interpret the Lakeshore's historic structures.[27] These zones are illustrated in **Figure 3**. The Au Sable Light Station itself encompasses 325.93 acres, and in 1978 was placed on the National Register of Historic Places. According to the National Register nomination, the property derives its significance from its use as a navigational aid on the 'graveyard coast,' and as "an excellent example of 19th century lighthouse architecture."[28] Additionally, it is "...the most accessible of the Park Service's Great Lakes Lighthouses [and] it is also an excellent example of a complete lighthouse complex from oil storage sheds to [the] fog signal building."[29]

History of Ownership

Michigan achieved statehood in 1837. Prior to the state's ownership, the land comprising the Au Sable Light Station is not believed to have been officially deed to anyone, although several Native American tribes lived and hunted on the land. Early French explorers and missionaries did visit the region in the 1600s, but there is no known record of ownership, deeds or surveys of the land. In 1856 the United States Government patented the land to the state of Michigan. Then, on September 6, 1872, Michigan returned 325.93 acres of land to the United States for the construction of the Au Sable Light Station for a sum of $407.41.[30]

While the United States government continues to own the Au Sable Light Station, responsibility for the management of the land and structures has fallen within the jurisdiction of four different government agencies over the course of the Station's existence. When the land was first acquired by the federal government, it was placed under the jurisdiction of the U.S. Treasury Department, which, in turn, had created the United States Lighthouse Service to administer the lighthouses throughout the country. The Treasury Department retained control until 1903, when jurisdiction went to the Commerce Department. Over thirty years later, under

Figure 3



Map of Pictured Rocks National Lakeshore showing the "Lakeshore Zone" and the "Inland Buffer Zone" of the park, 1990.

the Presidential Reorganization Act of 1939, the Lighthouse Service became part of the U.S. Coast Guard. Finally, on January 12, 1968, the Coast Guard transferred its jurisdiction of the Au Sable Light Station, with the exception of the light tower itself, to the National Park Service to become a part of Pictured Rocks National Lakeshore. The Coast Guard continued to operate the light tower as an unmanned facility, maintaining only the solar beacon (which was originally installed in 1958) until 1994 when it transferred the property to the Park Service. Since 1994, the Park Service has had responsibility for the entire Light Station.

Tabulated Chain of Title for Au Sable Light Station

1872 - 1903	U.S. Department of the Treasury, U.S. Lighthouse Service
1903 - 1939	U.S. Department of Commerce, U.S. Bureau of Lighthouses
1939 - 1968	U.S. Department of the Treasury, U.S. Coast Guard
1968 - 1994	U.S. Department of Transportation, U.S. Coast Guard LIGHT TOWER ONLY (approx. 30 SF) U.S. Department of the Interior, National Park Service, LIGHT STATION (excluding tower)
1994 - 1999	U.S. Department of the Interior, National Park Service, entire Light Station, including the light tower

Historic Background Analysis

A light station typically consisted of a complex of interdependent structures and was clearly and deliberately designed for utilitarian purposes. The light required a keeper who not only would replenish its fuel, but who would also maintain and operate it on a nightly basis. Because of these time-consuming responsibilities, and the overall nature of the job, the keeper

needed a place to live on site and, perhaps, some form of transportation. Thus, in addition to the light tower, one often finds at least one dwelling and privy, a fog signal building, and multiple storage buildings, including a fireproof oil house for the storage of flammable fuels, and some form of transportation storage, 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.

Construction of the Au Sable Lighthouse on Point Au Sable was completed in 1874. It was a two-story, red brick structure with an attic and a basement, and was attached to a brick conical tower via an attached brick passageway. Originally, the roof consisted of cedar shingles. These were eventually replaced by red, pressed-metal shingles shortly after the turn of the century. The first floor consisted of a kitchen, living room, bedroom, oil room, and a woodshed through which one had to pass in order to enter the building. Shortly after the turn of the century, the woodshed was transformed into the kitchen and the original kitchen space became the family dining room. The second story had four bedrooms.

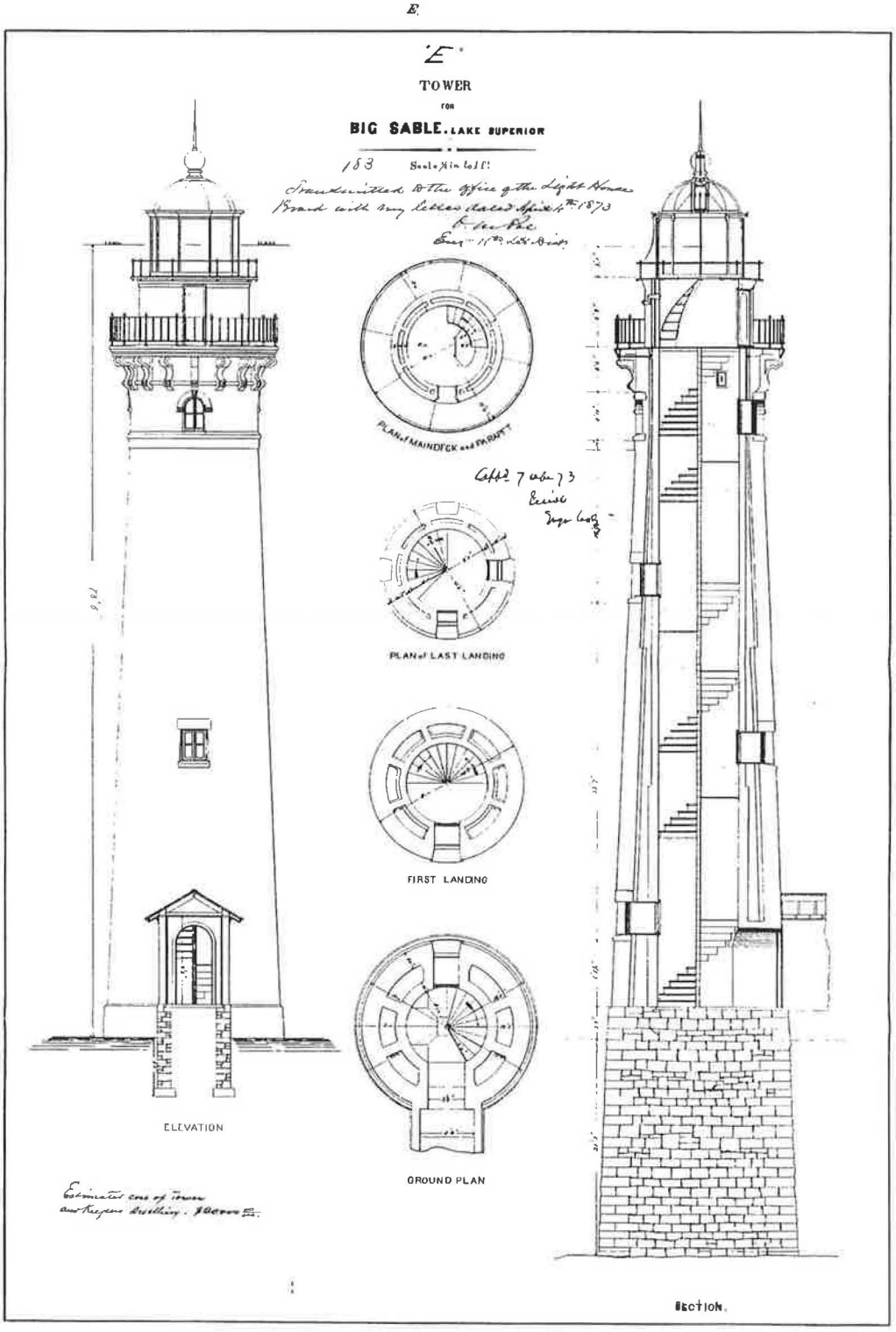
As was the case with other lighthouses built around the same time, design, engineering and technology standards had already been established by the Lighthouse Service for the construction of all new lighthouses. This is why a large number of lighthouses on the Great Lakes from this period of time are virtually identical. According to Charles K. Hyde, author of *The Northern Lights*, "roughly a half dozen proven designs were used again and again, including standard designs for coastal beacons, river lights and pierhead beacons. This practice saved vast sums of money since the engineers in the lighthouse districts avoided 'reinventing the wheel' every two or three years."[31] Nowhere can this be more clearly seen than at Au Sable, where it is believed that an original linen drawing for the 1874 keeper's dwelling is probably also the original drawing for the dwelling at Outer Island in the Apostle Islands of Lake Superior. The title "Outer Island" on the drawing is covered over with an old piece of paper saying "Point Au Sable." **Figure 2** is a photograph by the National Park Service of the original drawing which displays this name change.

Standard design, engineering, and technology standards were also utilized for the construction of new light towers, including the lanterns which capped the towers. Where before 1850 there were many different types of lanterns, after 1850 a polygonal design, either eight or ten-sided, became virtually universal on the Lakes. Au Sable's 10-sided lantern is no exception. Standardization of the light towers themselves did not occur until the 1870s. This was largely due to the fact that taller towers, which could provide a higher focal plane (and thus better visibility), were needed to replace outmoded structures at many stations. As a result, there was a flurry of new tower design and construction, which demanded standardization.

Often a new brick or stone conical tower was constructed and attached to an existing dwelling by a passageway. Hyde says that "the most common design [during the 1870s] was a conical brick tower, between eighty and one hundred feet tall, connected to the keeper's house by an enclosed passageway."[32] Because the lighthouse at Au Sable was built in 1874, much later than many of the other lighthouses constructed on the Great Lakes, it had several of the newly required design standards. The conical tower, for example, has a height of 87 feet and a focal plane of 107, and is attached to the keeper's dwelling via a covered passageway measuring 12-1/2 feet long by 5 feet wide. It has seven windows: four semicircular windows on the top landing, one on each of the other two landings, and one on the ground level. Virtually identical copies of the tower can be seen at a number of other light stations on the Great Lakes. This is because the same drawings that were used for the construction of the Au Sable tower were also used for the construction of the other towers.

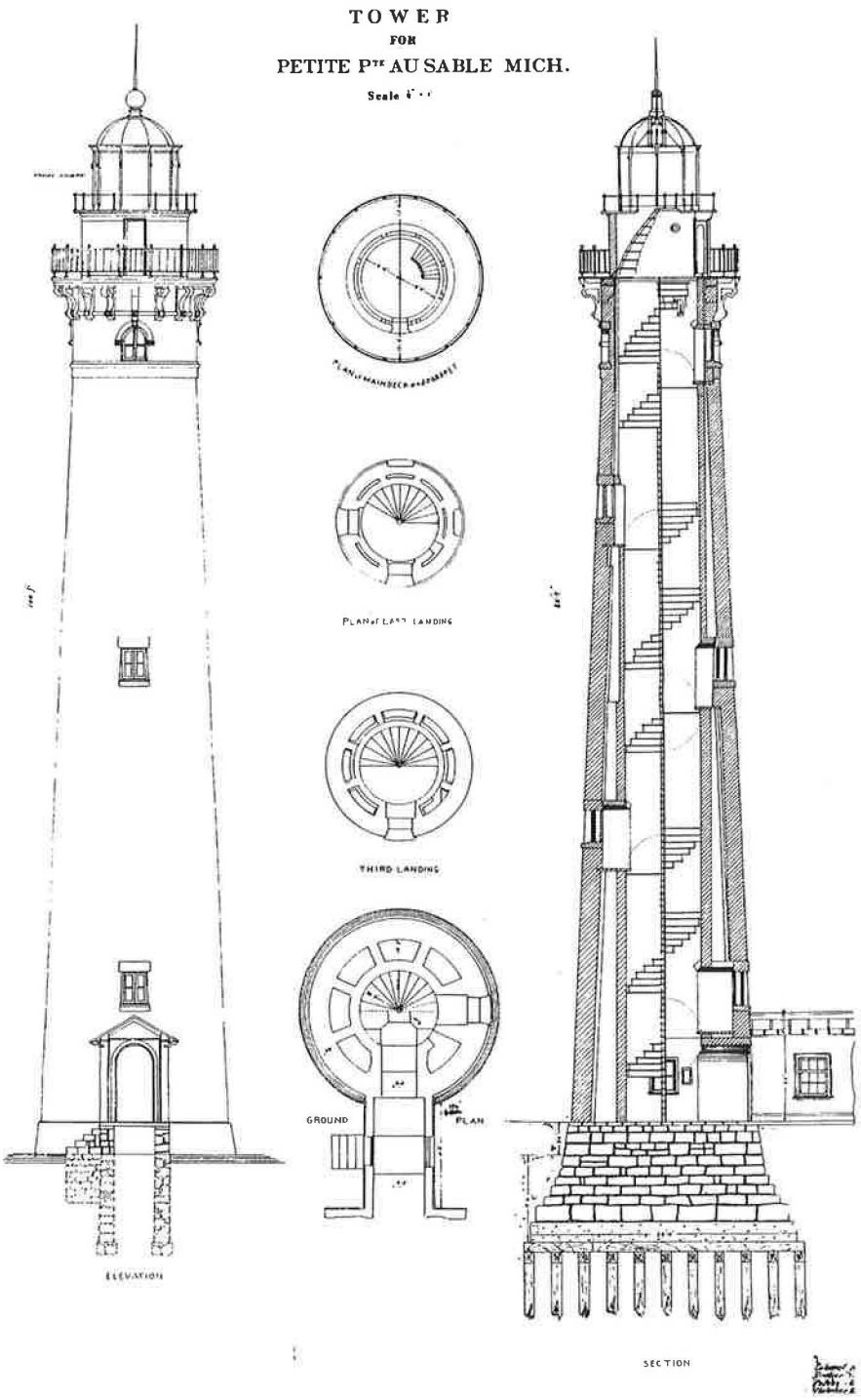
For example, identical versions of Au Sable's conical tower can be seen at South Manitou Island and at Petite Pointe Au Sable, both on Lake Michigan, Presque Isle on Lake Huron, and Grosse Pointe Light outside of Chicago on Lake Michigan. In comparing the construction drawings for Au Sable on Lake Superior and Petite Pointe Au Sable on Lake Michigan, **Figures 4 and 5**, one of the only discernible differences between the two towers is the foundation material. The foundation consists of wood piling at the Petite Point Au Sable tower while at Au Sable it consists of stone. The light station at Outer Island in the Apostle Islands archipelago in Southwestern Lake Superior not only has a tower that is identical to the one at the Au Sable Light Station, it also has an identical original keeper's dwelling.

Figure 4



Original construction drawing for the tower at the Au Sable Light Station, 1873.

Figure 5



Original construction drawing for the tower at the Petite Pointe Au Sable Lighthouse on Lake Michigan, Undated.

Any changes to the standard designs prior to the commencement of construction in either the dwellings or the towers were likely in response to the needs and constraints of the individual sites. This is clearly stated in a letter written on April 4, 1873 by O.M. Poe, Lighthouse Engineer for the Eleventh District, to Joseph Henry, Chairman of the Lighthouse Board:

> I have the honor to enclose herewith estimate of the cost of constructing a third order Light House and Keepers Dwelling at Big Sable [Au Sable], Lake Superior, together with a plan of proposed tower and plans of keepers dwelling.
>
> The plans of tower and keepers dwelling are of the same general features already carried out in several cases in this district, modified however to suit the locality.[33]

While it would appear that little, if any, thought was given to the architectural design of the "cookie cutter" towers built in the last quarter of the nineteenth century, this was apparently not the case. These towers exhibited Italianate characteristics, including decorative cast iron brackets supporting the exterior platform and elaborate crowns above the round top windows at the work room level. Italianate features were popular in residential design in America from the 1840s through the 1880s. Thus, during the period of time when these towers were being designed, the Italianate style was at its height. It appears that the lighthouse engineers carried over some of the ornamental features of this style from residential into civil design. In a letter dated January 9, 1873, referring to the Lighthouse Board's Annual Report, the Quartermaster General praises the Board saying:

> I rejoice to see that the Board is paying some attention to architectural design in the newer light houses, and that there is a prospect that hereafter the Bald towers which for so many years, while fulfilling their useful office, have in most conspicuous positions offended all persons of taste on their approach to our coasts, will give place, at very little increase of original cost, to buildings which it will be a pleasure to regard.[34]

The same attention to design and detail was carried over into other structures built at the lighthouse complexes.

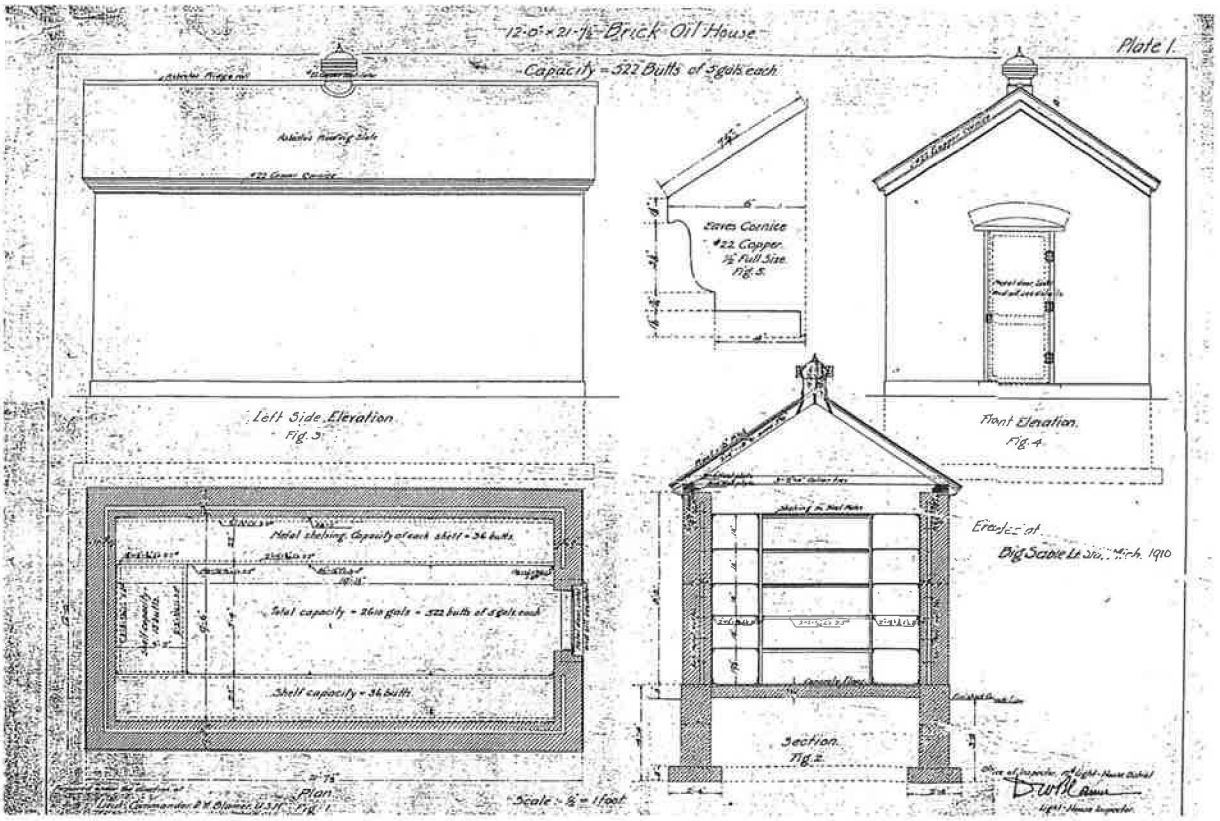
Outbuildings were often built in direct relation to the needs of a light station, and while they each had distinct functional roles with respect to the operation of the light station, they were also often interdependent. As was the case with many of the light towers and keepers' dwellings around the Great Lakes, standard plans were used for the construction of various outbuildings, and Lighthouse Service crews were responsible for their construction and maintenance. The result was virtually identical outbuildings from station to station. The differences, when they did occur, were usually due more to the substitution of materials that were available during the time of construction than to actual structural changes. For example, the brick oil house at Au Sable can also be found at Raspberry Island in the Apostle Islands, and at South Manitou Island in Lake Michigan. The only differences between the structures are their sizes, and the types and colors of bricks used. At Au Sable, the brick oil house is constructed out of red brick, which may have been left over from the construction of the keeper's dwelling, while the brick oil house at South Manitou was constructed out of three different types of salvaged bricks likely left by a passing lighthouse tender. The determining factor for the size of the various oil houses at each of the stations may have been the level of kerosene consumption, which, in turn, was probably based on the size of the lantern and the isolation of the station. **Figure 6** is a drawing of a typical brick oil house, in this case for Big Sable Light Station on Lake Michigan. Although the size of the structure in the drawing is significantly different than the one at Lake Superior's Au Sable, several of the architectural details, including the cornice and the ventilator, are identical.

Yet another example of a standard building type is the metal round oil house at Au Sable, built in 1915. This structure can been seen not only at Au Sable and many other light stations around the Great Lakes, but also at several Coast Guard stations (formerly the U.S. Lifesaving Service).

Oil Houses

Prior to 1895, oil, which used as fuel for the light, and other materials were stored in the keeper's dwelling. The original construction drawings for Au Sable indicate that the storage area was a specifically designated room in the southwest corner of the original keeper's dwelling. By 1888, it was decided to move the supplies stored in the oil room to the cellar, a safer location for the flammable materials. In 1894, the Lighthouse Board issued a directive that an oil house be built at Au Sable, an even safer alternative. It was constructed

Figure 6



Drawing of a typical brick oil house constructed at several Great Lakes light stations, 1910. A note on the drawing reads, "Erected at Big Sable Lt. Sta. Mich. 1910." This refers to a light station on Lake Michigan, not the Lake Superior Au Sable Light Station. The brick oil house at Au Sable has similar details but different proportions.

the following year out of brick, sited a short walk south of the keeper's dwelling.

In 1915, a second oil house was built. This structure was cylindrical in shape, rested on a concrete slab, and was constructed entirely out of iron. This structure, like the brick one, was used to store flammable materials, and consequently its entire interior was lined with brick.

Fog Signal Building

While the lighthouse itself was of primary importance, the fog signal also played an essential role, particularly when fog or smoke rendered the light useless. Since this was often the case in the Great Lakes region, fog signal buildings were constructed at a rapid rate during the last half of the nineteenth century. As with the towers, dwellings, and oil houses, the district engineer developed standard designs for the fog signal buildings in his territory. The result was that many of the fog signal buildings in the region were virtually identical, albeit with a few minor differences or alterations. For example, the one-story brick structure at Au Sable can also be seen at Raspberry Island (Figures 7 and 8). Annual reports of the Eleventh Lighthouse District from 1892 until 1895 repeatedly called for the construction of a fog signal building at the Au Sable Light Station. It was noted in one report:

> Big Sable, Lake Superior, Michigan — This important light-station is on the southern shore of Lake Superior, about halfway between Marquette and White Fish Point. The entire traffic of Marquette, which, it was stated, was some 1,772,400 tons in 1890 passes close to this station, and in time of southerly gales the whole commerce of Lake Superior hugs the south shore. A steam fog signal is required to complete the satisfactory equipment of the station.[35]

In June of 1897 the fog signal building at Au Sable was completed, and on September 1, 1897 it began operating. It consisted of a 10-inch steam whistle with duplicate boilers contained in a red brick structure with a red

Figure 7

Fog Signal Building, Au Sable Light Station, Lake Superior. Constructed 1897. (Photograph 1995).

Figure 8

Fog Signal Building, Raspberry Island Light Station, Lake Superior. Constructed 1903. (Photograph 1995).

metal shingle roof. Initially, the roof had two long metal smokestacks, but in 1904 they were removed and replaced with a 40' high brick chimney. The chimney's size was reduced to its current height of 3' above the roof line in 1954.[36] In 1898, a hoisting engine was installed in the Fog Signal Building to hoist a tram, which ran on a 55 foot tramway built between the dock and the fog signal building that same year. In 1928, the fog signal was changed from a steam whistle to an air diaphone system.

Privies

While a privy was built in 1874 in conjunction with the construction of the original keeper's dwelling, it no longer has any surface expression, although its foundation was partially excavated as part of the archeological research at the site. It was apparently torn down shortly following the construction of a replacement privy in 1909. In addition to this new, replacement privy, a second privy was constructed for the new keeper's dwelling (HS-09) which was also built that same year. Both privies still exist at the Light Station, and are constructed out of red brick with red metal shingle roofs. A distinguishing feature between the two structures is their roof forms. The replacement privy for the original keeper's dwelling (HS-11) has a gabled roof with pressed metal shingles that have a pattern which is unique at the station. The privy which served the newer keeper's dwelling (HS-09) is approximately the same size as the other, however, it has a hipped rather than a gabled roof, and pressed metal shingles identical to those at both of the dwellings. All three privies were situated on brick foundations and had brick cleanout chases topped with wood covers.

Other Structures and Changes

Throughout the years at the Au Sable Light Station various other structures and features have "complemented the collection of buildings, creating a complete light station complex."[37] These have included: a boathouse constructed circa 1873-1874; a 55-foot long tramway, running from the dock to the fog signal building built in 1898; three wood frame storage buildings (the first one constructed in the 1870s and located east of the original keeper's dwelling, the second one built circa 1903 south of the original keeper's dwelling, and the third constructed in 1909 south of the 1909 keeper's dwelling); and a 'hennery' or chicken coop, constructed circa 1909 toward the southern edge of the site.

In 1909, the Au Sable Light Station experienced the greatest amount of change since its establishment in 1874. A second keeper's dwelling was constructed and extensive alterations and additions were made to the 1874 dwelling. The older dwelling, which was originally designed as a single family dwelling, was converted into a duplex for use by the two assistant keepers and their families. The new dwelling, however, was to be solely for the head keeper and his family. Because of the increased number of people living at the complex, additional outbuildings were also constructed at this time.

The garage, at the west end of the complex, was the last structure to be built at the Au Sable light station. It was constructed in 1954, and is a wood frame struc-

ture with a flat asphalt roof. It has two overhead doors and space for two automobiles. Prior to its construction, there had been an earlier garage constructed in 1925, but it was two miles from the station as the road did not extend all the way to the lighthouse complex at that time.

Brief Photographic Chronology

Figure 9 is one of the first known photographs of the Au Sable Light Station, and shows it as it appeared in 1884. The tower, passageway, and keeper's dwelling appear as they were originally constructed, and the fog signal building has not yet been built. The only discernible outbuildings at the site, which no longer exist, include: the brick privy east of the keeper's dwelling; a wood frame structure (possibly used as a barn or as additional storage space) also east of the dwelling; and a boathouse. The boathouse appears to be proportionally different and closer to the dwelling than the current structure. One other interesting feature of the site in the photograph is the presence of wood boardwalks connecting the individual structures.

Figure 10 shows that by 1920 the station had several new significant additions, including a wood tramway with a turntable for moving supplies from the dock to the fog signal building; the fog signal building itself; a new boathouse with a marine rollerway alongside the dock; and, seen in the background of the photograph, the new keeper's dwelling situated west of the tower. The photograph also shows the addition and alterations made to the original keeper's dwelling in 1909.

Figure 11 is an aerial view of the complex looking southeast, circa the 1940s, which shows the station following its peak development. Discernible features not present in the earlier photograph of 1920 include the concrete seawall constructed in 1903 (which was later extended in 1942 to mitigate bluff erosion near the fog signal building) and the alterations, such as the dormer, made to the fog signal building for the installation of the air diaphone in 1928. Other visible structures include: the brick oil house; the metal oil house; two wood frame structures located south of the dwellings; and the concrete sidewalks which began to replace the earlier boardwalks in 1909. Furthermore, the dock is still present

Figure 9

View looking northwest of the Au Sable Light Station as it appeared in 1884.

Figure 10

View looking southwest toward the Fog Signal Building (HS-16) and the Boathouse (HS-17) from the water, 1920. Note the elaborate system for unloading supplies and transporting them to the Fog Signal Building.

Figure 11

Aerial view of the Light Station looking southeast, circa late 1940s.

near the boathouse, however, the tramway is not visible from the angle of this photograph.

Influences on Lighthouse Design and Materials

Although "lighthouses" are considered an architectural type in and of themselves, many of the standard designs developed by the lighthouse engineers, as well as their designated building materials, appear to have been influenced by period residential structures. One influence of late 19th century residential construction which appears at the Au Sable Light Station is the decorative pressed metal shingle roof. Decorative pressed metal shingles were very popular residential construction materials, and were advertised as being superior for roofs with a steep pitch, fireproof, "unbreakable," and were said to not come loose with expansion.[38]

Pressed metal shingles were most commonly steel or copper. For durablility, the shingles were often dipped in tin (tinplated or galvanized steel) or lead (terne-coated copper or steel). Steel shingles, galvanized or not, had to be kept well-painted with red lead or red oxide to retard corrosion. The various shingles used at Au Sable are of unknown composition, although references to rusting shingles discovered in a landfill on site and the documented need for regular painting implies an uncoated steel shingle.

The American vernacular influence can also be seen in the diamond-muntin pattern at four of the windows of the 1909 keeper's dwelling (HS-09) at the Au Sable Light Station. Diamond light windows were quite popular in residential architecture from 1900 - 1927. At Au Sable this pattern lent ornamentation to the otherwise streamlined facades of the building.

The overall massing and the stylistic influences of the tower and the keeper's dwellings at the Au Sable Light Station were likely not intentional, but rather a reflection of the architectural and design trends in both the region and the Untied States at the time of their construction.

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1 Charles K. Hyde, *The Northern Lights* (Lansing, MI: Two Peninsula Press, 1990),158.

2 Enviroscience, Inc. *Historic Structures Report, 95% Submittal, Au Sable Lighthouse Complex, Pictured Rocks National Lakeshore, Michigan.* Prepared for the U.S. Department of the Interior, National Park Service, Office of Planning and Resource Preservation, Division of Cultural Resources Management, Omaha, Nebraska (Eden Prairie, MN: 1991), III-1.

3 Ibid., III-1.

4 Hyde, 158.

5 Ibid., 158.

6 Ibid., 158.

7 Louis Torres, *Historic Structure Report, Historical Data, Au Sable Light Station, Pictured Rocks National Lakeshore, Michigan.* Prepared for the U.S. Department of the Interior, National Park Service, Denver Service Center, Historic Preservation Division (Denver, CO: November 1978), 9-10.

8 David Koenig, *National Register of Historic Places Inventory — Nomination Form [for] Au Sable Light Station* (East Lansing, MI: October 21, 1976), item 7, p.1.

9 U.S. Department of the Interior, National Park Service, Denver Service Center, *General Management Plan, Pictured Rocks National Lakeshore/ Michigan* (Denver, CO: September 1981), 4.

10 Ibid., 23.

11 Ibid., 24.

12 Ibid., 32.

13 Ibid., 39.

14 Ibid., 39.

15 Hyde, 31.

16 Rachel Franklin Weekley, *Historical Data Section: Cultural Landscape Report, Au Sable Light Station, Pictured Rocks National Lakeshore, Michigan.* Prepared for the U.S. Department of the Interior, National Park Service, Midwest Regional Office, (Omaha, NE: August 1994), 20.

17 Ibid., 20.

18 Hyde, 14-15.

19 James L. Carter, "Au Sable Light, Sentinel of the Great Sands," *Inland Seas* (Summer 1977), 97.

20 Weekley, 20.

21 Enviroscience, Inc., III-2.

22 Carter, 100.

[23] Ibid., 100.

[24] Ibid., 99.

[25] Hyde, 20.

[26] Carter, 104.

[27] *General Management Plan, Pictured Rocks National Lakeshore, Michigan*, 4.

[28] Weekley, 7.

[29] *Pictured Rocks National Lakeshore Interpretive Prospectus* (September 28, 1983), 23.

[30] Torres, 2.

[31] Hyde, 23.

[32] Ibid., 23.

[33] O.M Poe, Lighthouse Engineer for the Eleventh District to Prof. Joseph Henry, Chairman of the Lighthouse Board, 4 April 1873, Record Group 26, Letter Book 334, National Archives, p.298.

[34] Quartermaster General to Major Geo. H. Elliot, Engineer Secretary, U.S. Lighthouse Service, Washington, D.C., 9 January 1873, Record Group 26, Letter Book 312, National Archives.

[35] Weekley, 43.

[36] Torres, 25.

[37] Weekley, 7.

[38] Margot Gayle and David W. Look, *Metals in America's Historic Buildings* (Washington, D.C.: U.S. Government Printing Office, 1980), 14.

Part C:
Archeological Research Summary

Part C: Archeological Research Summary

Archeological Summary

Introduction

This section will analyze the material presented in the technical report entitled "Evaluative Investigations at the Au Sable Light Station, Pictured Rocks National Lakeshore, Michigan, 1990" authored by Bruce A. Jones of the Midwest Archeological Center (MWAC).

Abstract

Midwest Archeological Center personnel conducted two weeks of evaluative test excavations at 20AR193, the Au Sable Light Station, located at the eastern portion of Pictured Rocks National Lakeshore, in September of 1990. Undertaken in support of architectural and engineering consultation at Au Sable prior to the restoration of some of the site's buildings, the Center excavations exposed subsurface foundation profiles at six standing structures. Additionally, limited block excavations and trenching exposed the remains of two structures which had been previously demolished. The first of these, a brick privy, likely dates to the original episode of construction in 1873 - 1874. The second structure, a probable frame shed, was constructed somewhat later in time but, as observed in historic photographs, at least by 1884. Testing in front of the Double Keepers' Duplex Residence (HS-11) exposed an extensive pavement of dry-laid broken bricks. However, no clear evidence was found of a former structure east of the Double Keepers' Duplex Residence (HS-11), and no evidence was found to support the argument of the relocation of the 1873 - 1874 privy from its original location east of the Double Keepers' Duplex Residence (HS-11) to where the current privy (HS-15) is located, which is south of the Double Keepers' Duplex Residence (HS-11).

Project Methodology

The primary goal of the 1990 MWAC investigation was to assist in the completion of the Historic Structure Report of the site, focusing on HS-11, but including all nine of the standing structures at the site. Specific MWAC assistance included:

1. Undertaking controlled excavations adjacent to the foundations of HS-9, HS-10, HS-11, and HS-16, the four largest standing structures at Au Sable, together with additional excavations at the foundations of two smaller outbuildings, HS-13 and HS-15.
2. Gathering data regarding the presence and condition of several features/structures at the site which were illustrated in an earlier diagram of the station (specifically the 1909 Tinkham map), or were observed in historic photographs of the complex, but which no longer had any surface expression.
3. Monitoring several soil boring tests as they were drilled by Twin Cities Testing of Minneapolis, Minnesota.

All tasks were requested by Enviroscience, Inc. the contractor initially selected at the time to prepare a Historic Structure Report of the site (a 95% submission was completed). All tasks were accomplished, with the exact locations chosen by Enviroscience personnel at the large structures, and by MWAC at the additional areas. Work in all of the excavation units proceeded in arbitrary levels, initially by shovel and then by trowel. Selected fill from each of the six foundation exposures was then screened through 1/4 inch hardware cloth.

Site History

The entire site comprises an approximately 2 hectare (4-5 acre) cleared area on the wooded shoreline of Lake Superior. This point on Lake Superior's south shore is referred to as Point Au Sable and is, "a prominent exposure of Middle/Late Cambrian-age Jacobsville Sandstone at the extreme west end of the Grand Sable Dunes."[1]

In addition to the extant historic structures, several old photographs and a surveyor's map of the complex, drawn in June 1909 by Ralph Tinkham (see **Figure 53**, Part D), indicate that a number of other structures also stood on the site. These other structures were, in all likelihood, sheds and/or other structures of presumed frame construction, none of which have any present surface expression. Parenthetically, it is conceivable that some of the features illustrated on the Tinkham map were, in fact, added to it at later dates, in which case the map would illustrate more structures than actually stood at the site in June 1909.[2]

Prior Archeological Investigations

The Au Sable Light Station was awarded a formal Michigan state site number in 1976 (20AR193). However, archeological research undertaken at the site has not been extensive. The first and only known extensive,

professional investigation, prior to the MWAC 1990 undertaking, was in October 1977. The investigation consisted of pedestrian reconnaissance at the site conducted by archeologist Audrey Marie of the Denver Service Center. Her study:

> ... ultimately identified and described six historic features, three adjacent to or within the complex of standing structures and three around the southern perimeter of the clearing in which the station sits. All six features probably relate to occupation and operation of the light station. Two are the sites of small log structures, perhaps dugouts or bunkers which may be the remains of temporary housing for the 1873-1874 construction crew (Peter Hall, personal communication). The remaining four features are trash deposits which minimally date to the 20th century but may also contain earlier material.[3]

In addition, Bruce Jones undertook related archeological work at the site prior to the extensive work undertaken in 1990. He monitored the excavation and removal of several fuel tanks at the site by the United States Coast Guard in 1988, and undertook exploratory excavations at the east end of HS-11 in June of 1989 to document support features and materials prior to the reconstruction of the 1909-era porch. (At this time a circa 1936 concrete porch was extant.)

Description and Results of the 1990 Investigations

The results and analysis of the 1990 excavations, particularly with respect to the extant structures, have been more appropriately addressed in Part D: Architectural Analysis and Part F: Existing Conditions of this Historic Structure Report. However, several of MWAC's findings at the site, particularly those revealing general site characteristics, are summarized in this section.

The MWAC summarizes the findings of the site as heavily dominated by construction-related debris. In conveying his theory for their existence, Bruce Jones writes that:

> Cut and wire nails are present in considerable numbers, as are larger square shanked boat spikes. Despite their nautical name, the latter probably represent a general heavy duty fastener type well suited for construction on land. They would have had great utility in the timber and frame construction which probably occurred at the presumed boat docks and in several sheds built at Au Sable. Despite their length, however, many of the larger boat spikes in the 1990 collection are either bent or broken 1 1/2 - 3 in. below the head, suggesting that they were driven through relatively light stock and then clinched or bent over.[4]

The findings of these excavations provide evidence of the utilitarian function of the Lighthouse Service. Structures were continuously being removed and added to the station in relation to the efficiency of functions at the station. The site was isolated, thus construction and other materials were delivered in large quantities to sustain construction and necessary repairs for long periods. As a result, an abundance of materials, not necessarily the most suitable to the work being undertaken, were often used. The MWAC reported its findings, in relation to the continuous construction at the site, saying that this:

> ... suggests that the Au Sable station stored an ample stock of construction materials such as fasteners, a supply so great that heavy boat spikes could be essentially wasted on lighter construction. This may simply be another manifestation of the phenomenon observed in the area of the 1909-era porch at HS-11 (Jones 1989). In that instance the brick work for the step piers and porch columns was much more substantial (and utilized many more bricks) than would have been necessary for structural support of a light frame porch and two sets of wooden steps. Bricks were clearly not in short supply at Au Sable in 1909, and the evidence from the excavations around the F3 privy suggests that the smaller structures at the station, including those built of brick, were routinely demolished rather than salvaged and/or moved to alternative locations on the Au Sable reservation. The quantity of heavy fasteners recovered from the site in 1990 may well be another reflection of the same attitude.[5]

Conclusion

The 1990 MWAC report clearly analyzed several subsurface artifacts which relate specifically to the structures and cultural history of the light station. It is important to note that this is only one of the very few archeological investigations at this site. The potential for future investigations is extensive. Bruce A. Jones addresses this in his summary discussion and recommendations pertaining to the Au Sable Light Station when he states:

> In summary, the 1990 investigations have demonstrated that many of the subsurface historic resources at Au Sable Light Station are intact and that a considerable quantity of previously unknown features and information remain there to be addressed. The potential for disturbance and/or loss of this information base should be routinely addressed and carefully considered in the course of whatever ground disturbance activities will be necessary for the development of the Au Sable Facility.[6]

Therefore, the potential that the site may contain a significant number of archeological artifacts specifically related to the history of the Au Sable Light Station should be an explicit consideration of all future undertakings.

Soil Testing

Goals and Approach

In addition to the archeological investigation previously summarized, a geotechnical exploration program was undertaken at the Au Sable Light Station by Twin City Testing Corporation of Duluth, Minnesota under contract with Enviroscience, Inc.

The scope of services included:

1. Four (4) standard penetration borings at the site which extended to refusal or to a maximum depth of 30 feet, whichever was limiting.

2. A nominal amount of laboratory testing on selected soil samples to help judge their engineering characteristics.

3. An engineering report with boring logs, a sketch with borehole locations, results of laboratory tests, and recommendations and opinions regarding:

    A. Estimated bearing capacity of soils

    B. Recommendations for foundations

    C. Estimates of settlement

    D. Possible bedrock depths

    E. Surface drainage recommendations

It was noted that the purpose of the report was to present the results in relation to the above specifications, along with an associated engineering review, and not to determine the presence or extent of contamination at the site.

Results

Three test borings were drilled at the site, with the fourth location being inaccessible, on September 21 and 24, 1990. The elevation at each borehole was referenced to a 1977 benchmark labeled ASP-2. Surface elevations at the boring locations ranged from 627' to 630'.

All three of the borings indicated a generalized soil profile comprised of fine grained sand underlain by sandstone. Boring SB-3 encountered an initial 4 - 1/2' of fill. Refusal was encountered in SB-1 and SB-3 at 21' and 20.3', respectively.

Groundwater was encountered in each of the three boreholes. Twin City Testing Corporation stated, "It does appear that groundwater levels are beneath the basement and/or footing depths."[7]

Engineering Review

Project Data

The following review was based on information obtained from Enviroscience, Inc. pertaining to previous excavations undertaken by the National Park Service. This information was summarized as follows:

1. An excavation adjacent to the lighthouse tower indicated that the foundation may extend to bedrock, which is approximately 20 feet deep.

2. Two (2) excavations revealed portions of existing structures that extend below the anticipated frost depth, but do not have spread footings.

3. The excavations and the test borings indicated the soil profile to be predominately a fine grained sand. No exceptions were encountered in either the excavations or the boring logs.

Discussion

The opinion of Twin City Testing Corporation is that the predominately fine grained sand soils encountered at the site are free draining. Twin City Testing also stated:

> Enviroscience informed us that during driving rain storms, the masonry units are wicking moisture to the interior walls and causing damage to interior wall surfaces. It is our judgement [sic] that this problem may be a characteristic of the masonry units and not the soils surrounding the structures.[8]

However, the analysis of the existing architectural conditions was out the scope of work that was undertaken

by Twin City Testing Corporation. Twin City Testing was instructed to limit the scope of its report to recommendations and opinions for possible construction of spread footings under portions of the existing structures. With respect to their particular scope, Twin City Testing Corporation states:

> In our opinion, this construction may not be necessary. It is our understanding that the existing structures do not show detrimental signs of settlement or foundation failure in areas where no spread footings are present. If areas of distress are encountered during restoration, we should be contacted to review our recommendations and evaluate possible alternatives.[9]

Field Exploration Procedures

Soil sampling was performed by Twin City Testing Corporation in accordance with ASTM:D1586-84 and was both visually and manually classified during field work by the crew chief in accordance with ASTM:D2487-85 and 2488. Representative samples were then returned to the firm's laboratory for further examination and for verification of the assigned field classifications. Furthermore, selected samples were also submitted to a program of laboratory tests. The results are contained in the charts provided in Twin City Testing Corporation's report.

Summary of Boring Logs

Sandstone was found in each of the borings at an approximate depth of 20' to 24'. Furthermore, the soil was water-bearing from 19 1/2' to 24' below grade.

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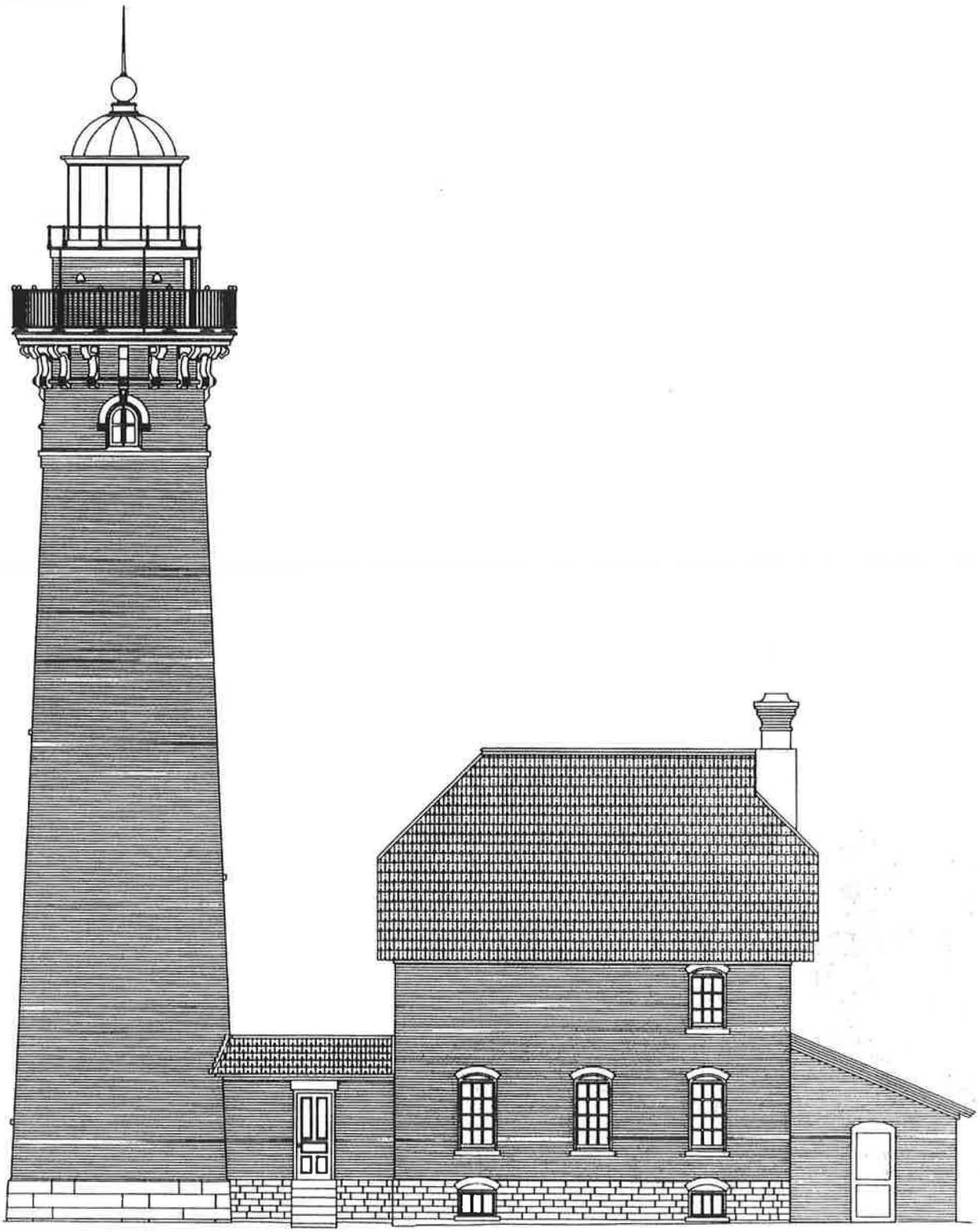
1. Bruce A. Jones, *Evaluative Investigations at the Au Sable Light Station, Pictured Rocks National Lakeshore, Michigan, 1990*. Prepared for the U.S. Department of the Interior, National Park Service, Midwest Archeological Center (Lincoln, NE: 1994), 2.
2. Ibid., 3.
3. Ibid., 4.
4. Ibid., 23.
5. Ibid., 23.
6. Ibid., 24.
7. Twin City Testing Corporation, Geotechnical *Exploration Program, Proposed Restoration Construction, Au Sable Lighthouse, Au Sable Michigan* (Duluth, MN: 1990), 4.
8. Ibid., 5.
9. Ibid., 6.

Part D:
Historic Architectural Analysis

Figure 12



Drawing of the Original Keeper's Dwelling, now referred to as the Double Keepers' Duplex Residence (HS-11). This depicts the building prior to the changes of 1909, but was drawn in 1949 with revisions in 1950.

Part D: Historic Architectural Analysis

The extant structures at the Au Sable Light Station appear relatively the same as they did in the 1950s, just prior to the automation of the light station. The last significant change affecting the overall appearance of the complex was the removal of two wood frame structures south of the keepers' dwellings. Most of the physical change that has taken place since the 1950s has been due to neglect, such as uncontrolled natural growth which has blurred the previously defined edge of the site. The deterioration of both exterior and interior materials and finishes at all of the structures is also directly correlated with the lack of maintenance for the ten years that the complex was virtually abandoned. Since its acquisition of the complex in 1968 (with the exception of the light tower which it did not acquire until 1995) the National Park Service has been implementing procedures to mitigate the continuous problems of deterioration and vandalism at the complex, while, at the same time, providing maintenance and stabilization of individual structures. Furthermore, from 1988 through 1990, the National Park Service undertook efforts to restore the public areas of the station to the 1909-1910 period of interpretation. This work included the removal of several non-period interior elements and the restoration of period fabric and finishes to interiors of the Double Keepers' Duplex Residence (HS-11) and the Tower (HS-10).

Double Keepers' Duplex Residence (Original Keeper's Dwelling) (HS-11)

General Observations

When the Au Sable (originally called Big Sable) light station was first put into operation in 1874, the main structures included the original keeper's dwelling, now referred to as the Double Keepers' Duplex Residence (HS-11), with an attached covered passageway leading to the tower (HS-10), as illustrated in **Figure 12**. A significant portion of the extant building material of these three structures dates to the original construction of 1874.

The significant amount of extant original material, and its good condition, can be attributed to the importance that the United States Lighthouse Service placed on building its structures with solid, durable materials and the strict maintenance guidelines that keepers had to follow. An example of this attention to the quality of materials can be seen in the construction specifications for the Split Rock Lighthouse in Minnesota, which state, "All framing lumber will be good merchantable [sic] white pine or Norway, free from the usual defects."[1] Although the specifications for the Au Sable structures have not been located, it can be assumed that the same standard of quality was sought for these structures as well, and for all of the light stations under the auspices of the Lighthouse Service.

Interior

The original keeper's dwelling (HS-11) at Au Sable was a two-story, single-family residence. The building was approximately 29 feet by 31 feet, and had an attached one-story, brick wing with a shed roof that was approximately 12 feet deep and extended the full length of the east end of the building. Mark Chavez described this wing in his 1994 report, stating that, "Its [the one-story wing] floor was on the ground level and it incorporated within its walls stone steps down to the basement and up to the first floor. The steps to the basement are visible [today], as they were incorporated into the south basement stair run."[2]

Apparently the one-story wing, intended as an unfinished woodshed, originally had a dirt floor and unfinished interior brick walls. The interior walls and the floor were finished to transform the space into a kitchen circa 1898. The dwelling's chimney, which ran alongside the west wall of the space, provided the necessary ventilation for the kitchen stove. The relocation of the kitchen allowed the original kitchen space, Room 108 in the dwelling, to become the dining room, a luxury not previously available to the isolated keeper and his family. It appears that by 1903, the floor of the kitchen (probably boards placed directly on grade) needed to be replaced, as noted in a letter from the district inspector to the Lighthouse Board. A keeper's journal entry of that same year also states that, "[A] Repair crew [is] laying [the] floor in [the] Kitchen ..."[3]

Physical observation by Chavez in 1988 revealed extant evidence of some of the original kitchen features of the one-story wing, which were not destroyed during later construction alterations. He notes that:

> These remnants are visible in the crawl space underneath the kitchen addition. A stone foundation wall includes a ledge for floor joists and a base for the brick wall. In the inside of this brick wall are remnants of plaster and whitewash, due to the conversion of the woodshed into a kitchen. Two earlier Keeper's log entries lend credence to that theory. On April 20, 1898, the log reads, "I whitewashed the kitchen today - one coat today." Then of September 23, 1901, "We have

> made the 27 feet of walk around the outside of the kitchen." The dimension of the woodshed and the two story addition that replaced it, in a north-south direction is exactly twenty-seven feet.[4]

Chavez also found additional evidence of change in Room 108, (which was the Dining Room after circa 1898) including evidence of the presence of historic wainscoting, and the presence of a non-historic baseboard, presumably installed following the removal of the wainscot. Chavez noted a change in the integrity of the plaster at approximately the top of the historic wainscot, saying that, "The plaster below approximately 40 inches is smooth, with paint basically intact; above this line the plaster is considerably more deteriorated, with peeling paint."[5] Additional destructive investigation by Chavez revealed that the plaster above the 40" line (the top of the historic wainscot) was attached to a wood lath, while that below the line was attached to a wire lath, indicating the application of plaster following the removal of the wainscot. The adjoining closet, Room 109, is the former pantry. The historic wainscot was intact in Room 109 at the time of the 1988 physical investigation, and in 1989, was used to duplicate and reconstruct the wainscot throughout Room 108.

Another designated room in the original dwelling was the Oil Room, now referred to as Room 107. This room, which was used to store the oil that fueled the light, is adjacent to the passageway that leads directly into the tower (HS-10). Historic references suggest that by 1888, the room was no longer used for oil storage, however. For example, a letter from the district engineer to the Lighthouse Board in June of 1888 states that, "A door frame and door, with necessary fittings, were provided for dividing the cellar into compartments so that supplies of oil and provisions could be kept separate [from the living quarters]."[6] The supplies and provisions were stored in the cellar space until 1895, at which time they were then stored in the Brick Oil House (HS-13) constructed that year. Furthermore, *The Description of Buildings, Premises, Equipment, Etc. at Au Sable Light-Station,* compiled in 1909, states that, "A service room fitted with bench, table and glass box, is situated in the dwelling near the passage to [the] tower," suggesting that by 1909 the room was used as a workroom.[7] Its proximity to the tower was convenient for the keeper, allowing him to use the room throughout the night, while remaining close to the tower where he had to constantly check the status of the light, trim the wicks, fill the oil, etc. However, a keeper's journal entry of October 1, 1921 states, "Polishing oil cans in the oil room."[8] Based on this statement, it is presumed that while the room functioned mainly as the keeper's evening work space, as late as 1921 it was also used to store the needed evening's supply of oil for the light.

Heating

The original heating system for the building consisted of wood- or coal-fired cast-iron stoves located in the rooms surrounding the chimney.

Exterior

Windows

As evidenced in historic photographs, such as **Figure 13**, all of the windows of the original keeper's dwelling (HS-11) had brick, arched head openings. All of the first floor windows, and all of the windows on the east and west elevations, had six-over-six double hung wood sashes. The second floor windows at the north and south elevations had three-over-six double hung wood sashes. There was also one attic window on the west elevation which had a wood casement. These original fenestration characteristics can also be seen at the identical keeper's dwelling at the Outer Island Lighthouse, shown in **Figure 14**, which, unlike Au Sable, has undergone relatively little change since its original 1874 construction.

All of the original windows of the Au Sable keeper's dwelling, even those at the basement, had solid panel wood shutters that were originally painted white, as seen in **Figure 15**. The shutters that had not already fallen off were apparently removed during the 1909 construction alterations and were never replaced. Mark Chavez states that the, "Wood shutters were evidently removed sometime between 1904 and 1912."[9] He also says that, "Evidence of [the] shutter hardware is discernible today, especially the shutter 'dogs' that held the shutters in an open position."[10]

Roof

By comparing early photos of the structure, one can discern that the roof surface was not originally metal, as it is today, but was a material which weathered. As Mark Chavez points out, "In two 1884 photos the roofing is clearly visible, and it is still light in color due to its newness. In the 1904 photograph, the roofing has darkened noticeably with age."[11] Furthermore, physical investigation undertaken by Chavez at the area

Figure 13

View looking southwest toward the original keeper's dwelling (HS-11) and the Tower (HS-10) prior to the addition and alterations, 1884.

Figure 14

View of the west elevation of the Keeper's Dwelling, attached Passageway, and Tower at the Outer Island Light Station, Lake Superior, (now part of the Apostle Islands National Lakeshore), 1984. Note the overall similarities with the Keeper's Dwelling (HS-11) at Au Sable prior to its 1909 alterations (Figure 15).

Figure 16

View looking southwest at the former exterior east wall of the Double Keepers' Duplex Residence (HS-11), now enclosed in the attic of the two-story 1909 addition, 1995.

Figure 15

View looking northwest of the Au Sable Light Station as it appeared in 1884.

where the east portion of the original roof is enclosed within the 1909 two-story addition, (**Figure 16**), yielded evidence to conclude that the original shingles on the 1874 structure were wood. He found that:

> This preserved portion of roof [within the attic space] had metal slates on it, with tar paper underneath that seemed practically new. On the sheathing underneath were found two sets of nail holes: Those for the metal roofing, and those for the wood shingles. Several of the wood shingle nails had been driven into the sheathing and slivers of wood around the heads. Therefore, at some point between 1904 and 1909, when the addition was constructed, the first metal 'slate' roof was installed on the Keeper's Dwelling (HS-11). It is very likely that between 1909 and 1958 at least one more re-roofing occurred. This is based on the observation of a great quantity and dispersion of rusted metal shingles around the site, including the trash dumps.[12]

A letter from the district engineer to the Lighthouse Board of July 18, 1903, however, dates the change from wood to stamped metal shingles more precisely, stating that, "$550.00 was requested for a new 'metal slate' roof laid on building paper."[13]

It appears that the original construction did not include a roof drainage system, as seen in historic photographs, such as **Figure 13** of 1884. It is very likely, therefore, that gutters and downspouts were first installed at the dwelling in conjunction with the installation of the metal roof in 1903. The first photographic evidence of a gutter and downspout is found in a historic photograph of 1904, **Figure 17**, which reveals a semicircular gutter along the entire length of the dwelling leading to a downspout at the east end of the north elevation. The downspout appears to continue down into the ground, presumably leading to a drain pipe with an outlet at the bluff. The photograph also shows that there was no gutter on the attached passageway.

Figure 17

View of the north elevation of the original keeper's dwelling (HS-11), attached passageway, and Tower (HS-10), 1904.

Foundation

The original foundation walls of the structure have remained relatively unchanged since their initial construction in 1874. The "finished wythe of stone [above grade] is primarily cut and shaped limestone with a few dense [dark red] sandstone blocks intermixed."[14] These cut stone blocks are laid in mostly stretcher bond and are approximately 14" long by 6" in height. Bruce A. Jones observed the subsurface condition of the walls at an excavation alongside the north foundation wall. He states:

> The [1874] wall exposed in X2 had no footing; the reddish-purple sandstone blocks and mortar of the bottom course were simply laid in clean sand. A mortar lip at the base of the first course probably defined the width of the trench in which the masonry wall was laid. The sandstone and mortar continued upward to roughly 1.15 m (45 in) below the ground surface, at which point a thin mortar parge coat was applied to the sandstone blocks. The upper edge of the parge coat terminated at present grade, while the lower edge ended in a 2.5 cm (1 in) lip which protruded 10-15 cm (4-5 in) from the sandstone wall. The mortar lip probably marked the level to which the lower wall was backfilled prior to the application of the parge coat.[15]

Furthermore, the stone of the subsurface portion of the foundation walls is not as uniform, both in size of the individual stone blocks and in their coursing, as those above grade. This appears to be a typical condition of the structures at the Au Sable Light Station.

Alterations to the Double Keepers' Duplex Residence (Original Keeper's Dwelling) (HS-11)

General Observations

The 1909 construction alterations at the original keeper's dwelling (HS-11) included demolition of the one-story kitchen wing at the eastern end of the structure, and the construction of a two-story addition in the same location. The addition provided the required space to sufficiently convert the structure from a single-family dwelling into a duplex. Each residence had its own entrance from a new covered porch that was constructed along the entire width of the east elevation.

The conversion of the dwelling into a duplex was proposed by the Eleventh District Engineer, as is seen in his letter of May 1909 to the Lighthouse Board which states, "...so that the lower floor may be used by one assistant and the upper floor used by the other. The original woodshed must be reconstructed (recently used as a kitchen) and other alleviations. Cost c. $2,450. Should be done as soon as construction of a new dwelling will permit the dismantling of the old one. Work done by days' labor."[16] The "new dwelling" referred to in this letter is the new Keeper's Dwelling (HS-09), also constructed in 1909, west of the converted original keeper's dwelling (HS-11).

Interior

Openings

Presumably, there had only been one door opening between the main portion of the structure and the woodshed/kitchen wing. This door opening, now designated as Door 108.B, remains relatively unaltered, and connects the Kitchen (Room 110) and the Dining Room (Room 108). However, at the second floor, due to the 1909 addition, the original east elevation, which had two windows, became an interior wall. Therefore, as part of the construction alterations, the south window of the east elevation was converted into a door opening, (Door 210.B), while the north window was infilled and completely plastered over. Physical investigation in 1995 did not reveal any remaining physical evidence of either of these original window openings.

Plumbing

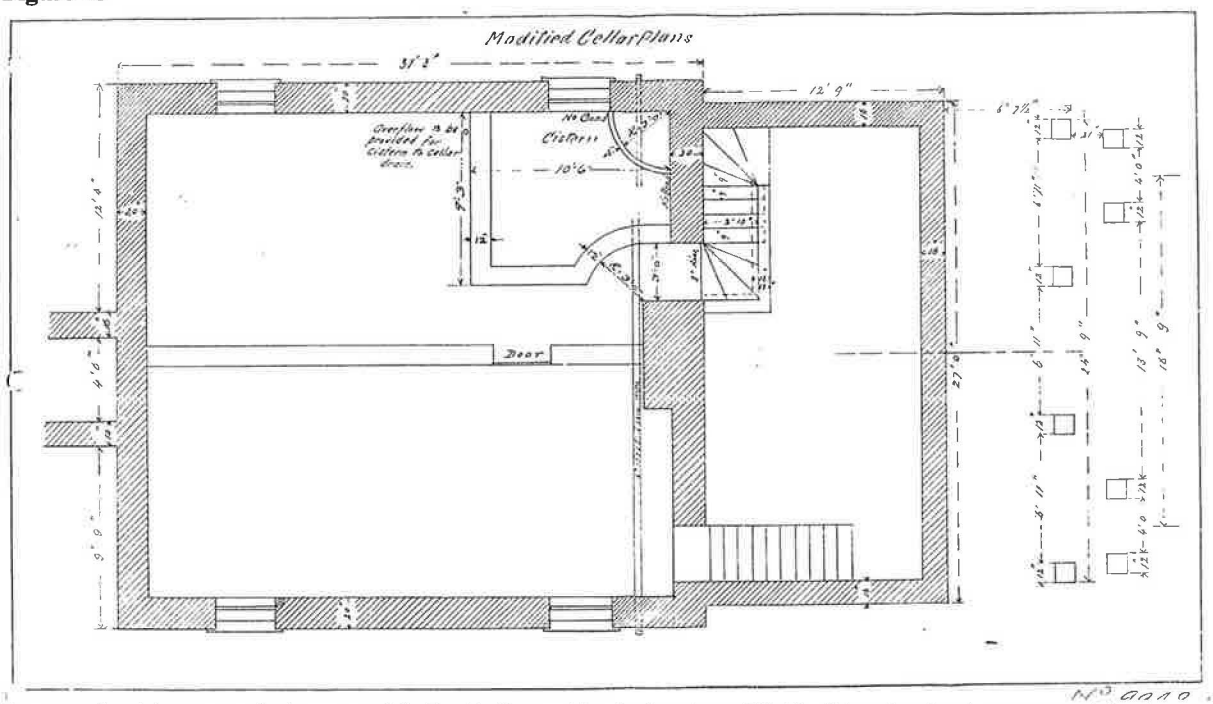
One significant feature of the 1909 alterations was the addition of a cistern in the northeast corner of the basement, as shown in **Figure 18**. The cistern was constructed of brick and coated with plaster, and, as described in the 1909 *Description of Buildings, Premises, Equipment, Etc.*, had a 700 gallon capacity. Rainwater was collected from the roof of the dwelling via the circa 1903 gutters and downspouts, then fed into the cistern where it was stored for domestic use. Presumably there was a hand pump at both the first and the second floor kitchen sinks to pump the water up from the cistern. However, the *Description of Buildings, Premises, Equipment, Etc.* also states that water was, "obtained by bucket for domestic use."[17] It is unclear whether this means that water was drawn from the cistern with a bucket or that the keepers collected water from the lake and carried it in buckets to the house. Eventually, however, it is assumed that hand-pumps were installed. One obvious concern, looking back at the system that collected water from the roof, which was coated with lead-based paint, were the effects of the toxic runoff on the keepers and their families living at the station. Health issues do appear to have been a concern, even in the 19th century, as noted in an excerpt of Lighthouse Service regulations entitled, "To Purify Rain Water at Light-House Stations," which states:

> Water contaminated with chloride of lead from salt spray resting on the roof of Light-houses, etc., whence the rain water is collected, does not lose its poisonous qualities either by boiling or by exposure to the air. To purify this water, and render it perfectly fit for all culinary and domestic uses, it will only be necessary to put some powered chalk or whiting into each cistern in which such rain water is collected, and to stir it up well, occasionally, after rain has fallen.[18]

In addition to the water collected by the roof gutters, water was also fed into the cisterns directly from the lake. A 1935 description of the station describes how this was achieved. It states that, "A cistern is located in front of fog signal for overflow cooling water. An overhead open metal tank in fog signal rides on the air pump. By valve water is pumped through [an] overground 1 1/2" pipe to cisterns in each dwelling."[19] This system was used until the drilling of a 220' well west of the Keeper's Dwelling (HS-09) in 1951. Following the well installation, the former system was removed, as stated in a keeper's journal entry of that year, in which he states that the, "Crew turned to take pipes out near fog signal to lake and put pipes away. We are getting water from the well and carring [sic] water to drink from lake until water is clear in the well."[20]

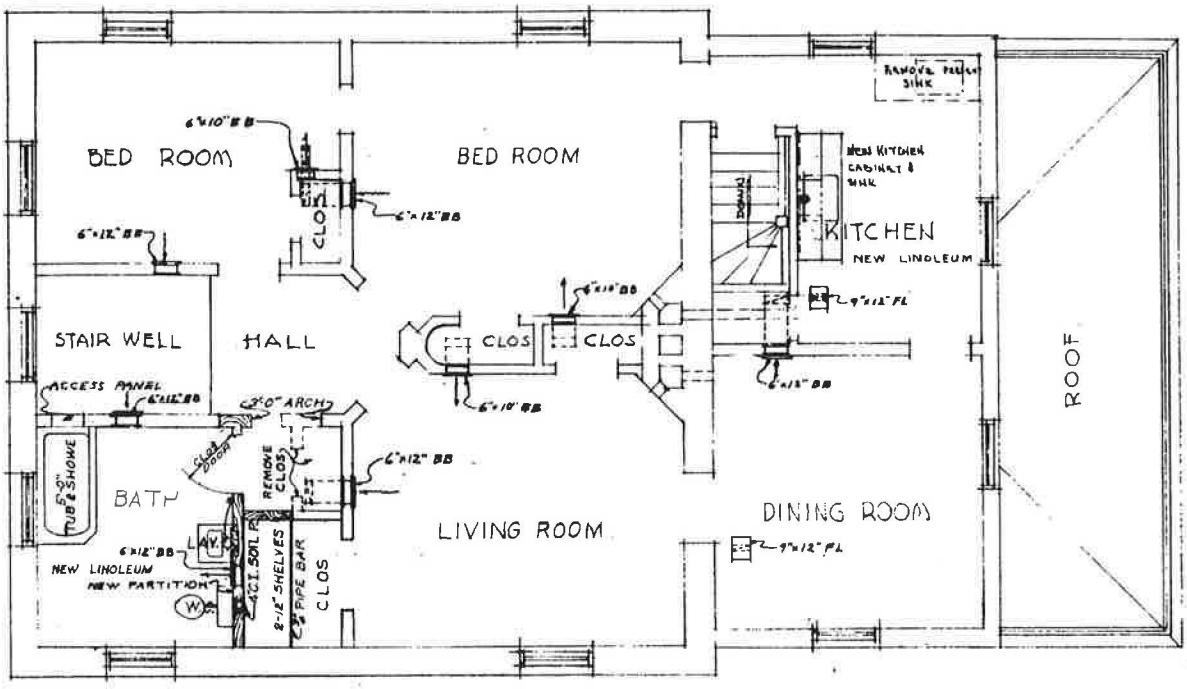
Physical investigation in 1995 revealed that the downspouts are no longer connected to the cistern, however,

Figure 18



Drawing of modifications to the basement of the Double Keepers' Duplex Residence (HS-11). Although undated, it is assumed that this was drawn just prior to the undertaking of the modifications in 1909.

Figure 19



Drawing for modifications to the second floor of the Double Keepers' Duplex Residence (HS-11) which includes modifications to the bathroom and the installation of central heating. Drawn in 1949 with revisions in 1950.

some evidence of the original connections was observed. Holes in the floor joists south of the cistern indicate the location of what was referred to as the ' 4" wrot [sic] iron pipe,' in the historic drawing entitled, "Modified Cellar Plans," **Figure 18**. This pipe fed water from the downspout at the south elevation of the dwelling into the cistern. Another remnant of the drainage system that was observed was what appeared to be a brick and concrete boot encasing a metal drainpipe at the north elevation of the building, which provides extant evidence of the downspout at this elevation.

The only remaining discernible evidence of plumbing fixtures in the second floor kitchen (Room 201), is at the northeast corner of the room. At this location, a butt joint indicates that an area of the wood floor boards, approximately 4'6" long x 2'0" wide along the north wall, has been replaced. As indicated on a historic drawing of 1949, **Figure 19**, the kitchen sink was located here. The drawing shows the removal of this sink, suggesting the subsequent replacement of damaged floor boards, and the installation of new kitchen cabinets and a sink along the west wall. There is a similar, but much smaller, patched area of floor boards at the northeast corner of the first floor kitchen (Room 110), which, as at the second floor, is the location of the original sink.

Heating

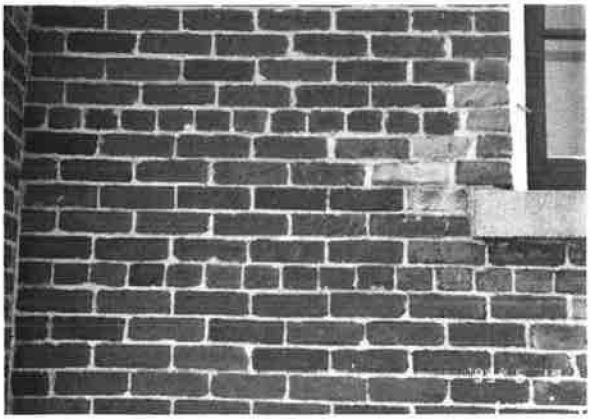
When the original keeper's dwelling was converted to a duplex in 1909, the heating system was unchanged. The kitchens, dining rooms, living rooms, and master bedrooms were each heated by a cast iron stove. In 1950 the Coast Guard replaced the cast-iron stoves with a central, forced air heating system. All of the equipment related to this system was removed as part of the restoration work undertaken by the National Park Service in 1989 to return the interior of the structure to its appearance of 1909 - 1910. Physical investigation during 1995 revealed that all previous openings for registers and related grillwork were patched with historically accurate materials.

Exterior

Openings

With the exception of the east end addition, the only noticeable change at the exterior of the original keeper's dwelling (HS-11) was the alteration of the window openings. As stated by Mark P. Pfaller Associates in 1981:

Figure 20



Detail view of the brick replacement adjacent to Window 2-3 of the Double Keepers' Duplex Residence (HS-11), 1995.

Figure 21

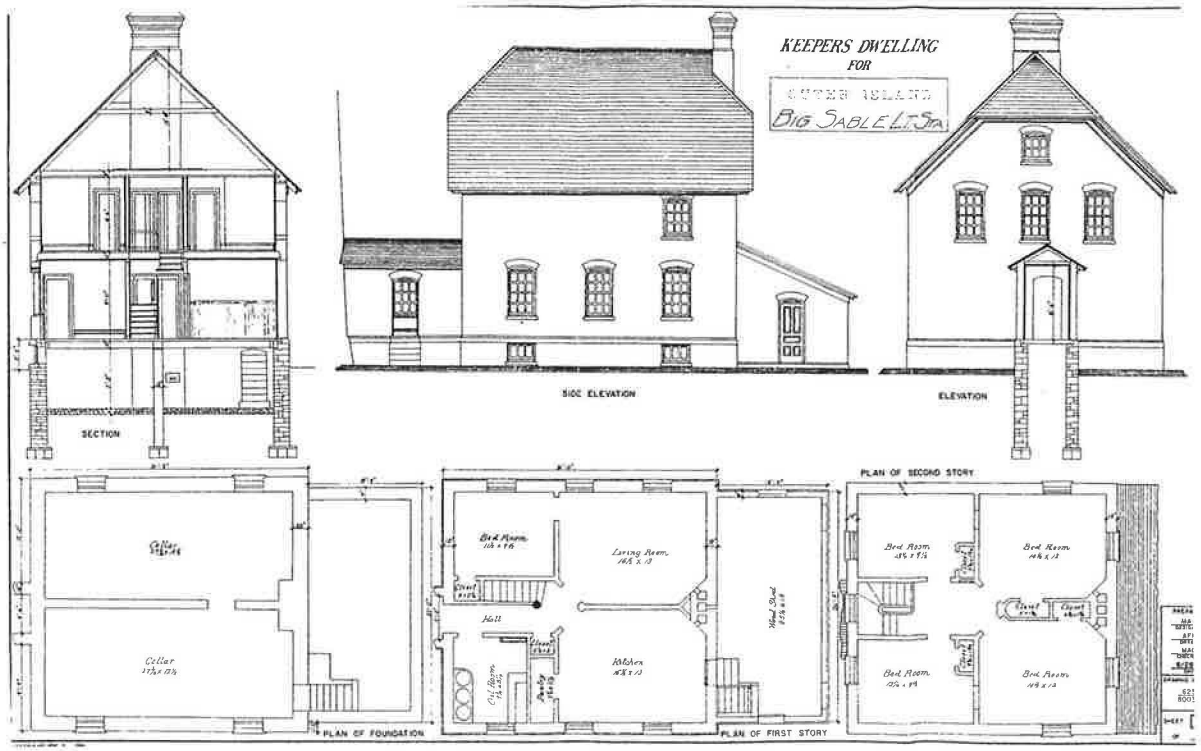
View of the west attic window at the interior of the Double Keeper's Duplex Residence (IIS-11), 1987. Note the toothed brick revealing the ghosted outline of the former window opening with an arched head.

> Concrete lintels and sills were installed and the windows were replaced by one-over-one double hung sash units. These windows could have been changed for either structural or aesthetic reasons, but another possibility is that these changes were made to standardize window replacement parts. A circular dated 1862 calling for such a standardization stated, 'It is desired that in the erection of new dwellings for light-house Keepers and when extensive repairs are made to existing ones, that but one size glass, (viz., 10 by 12) be used for the windows. A uniform size of glass for the windows of all lighthouse Keepers' dwellings may be in this way gradually introduced, greatly to the convenience of repairing broken window panes, and to the economy of the service.[21]

Physical investigation revealed that an irregular joint is visible at each of the window openings where the bricks were "toothed" back in around the perimeter of the opening, as seen in **Figure 20**. The extent of the brick arch and jamb modifications, from arched heads to lintels and the widening of the openings, is even more apparent at the interior face of the original attic window at the west elevation, as seen in **Figure 21**. This photograph reveals that not only were the brick arches replaced with concrete lintels, but the actual sizes of the openings were altered as well. Not all of the window sills were replaced in 1909, however, and as a result, there is an inconsistency in material at the sills. Four of the original stone sills, which have a bush-hammered face with a tooled draft at the perimeter, remain near the east end of the 1874 portion of the dwelling.

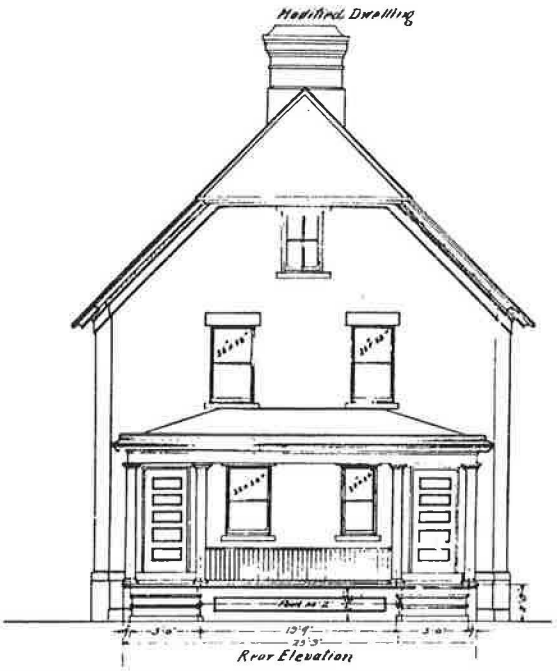
The only extant door opening that dates to the original 1874 construction is at the attached passageway. The original exterior door into the dwelling was at the one-story wing, and was subsequently demolished to accommodate the two-story addition in 1909. The extant door opening at the passageway has a concrete lintel, presumably altered from a brick arched head in 1909. Although there is no photographic evidence of the opening with a segmented brick arch, the original construction drawing of 1874, (**Figure 22** is a tracing of the drawing, by the National Park Service), shows an arched opening, as well as an arched head window directly opposite the door, at the north wall of the passageway. The panel configuration of the current door at the passageway is a five-panel, the same configuration as the original exterior door of the one-story wing before it was demolished, as indicated on **Figure 22**.

Figure 22



Tracing of U.S. Lighthouse Service drawing depicting the original keeper's dwelling and attached passageway constructed at the Au Sable Light Station and the Outer Island Light Station, both on Lake Superior. Undated.

Figure 23



Undated drawing of the east elevation of the Double Keepers' Duplex Residence (HS-11).

The 1909 drawing for the alterations to the structure, **Figure 23**, indicates that the two doors on the east elevation at the full width porch had a horizontal five-panel configuration. However, physical investigation revealed that the extant doors are four-panel, stile-and-rail (ladder) with the top panel being glass. Further, no photographic evidence has been found showing the horizontal five-panel configuration doors actually on the structure. Additionally, the drawing of the south elevation in the same 1909 set of alteration drawings also indicates a five-panel horizontal configuration door at the attached passageway, of which there is also no photographic or physical evidence. It is, therefore, assumed that although the 1909 drawings indicate five-panel horizontal configuration doors, they were never actually installed at the exterior door openings.

Drainage

The dwelling's drainage system was also altered in 1909, presumably in coordination with the installation of the cistern. A 1920 photograph of the north elevation, **Figure 24**, reveals that the downspout on that elevation is further west, approximately 10 ft. from the east end of the dwelling, than it was in photographs prior to 1909. At the south elevation, there is a series of small holes, which extend vertically up the brick surface, approximately 4'-0" west of the change in foundation, and just east of Windows 1-4 and 2-4. These holes are the remaining evidence of the brackets which once held the downspout in place at this elevation. Both downspouts fed pipes that diverted water to the cistern. The porch had a gutter running its entire length, which fed into two downspouts, one at the northeast and one at the southeast corner. This additional water collection for the cistern may have been an afterthought, as it is not present on the historic drawings for the drainage system alteration (**Figure 18**). Replacement downspouts were installed at the same porch location by the National Park Service in 1989, which continue below grade and feed perforated plastic pipes which divert water away from the porch.

Lightning Protection

Figure 24 reveals the structure's lightning protection system, which consisted of a lightning rod connected to the chimney cap. A grounding cable connected to the rod was attached directly to the roof and brick surfaces, and continued down the north elevation of the dwelling into the ground. This cable was most likely twisted copper, and appears to have been painted black. Physical investigation revealed a conspicuous stain on the brick surface, as seen in **Figure 25**. One assumption is that this discoloration is due to paint runoff from the lightning conductor, while another is that the stain is the result of water leakage from the downspout, which was located in the same location prior to 1909. Both assumptions are valid, and the staining may actually be a combined result of both factors. With respect to the lightning protection system, an excavation conducted in 1990 below the area of staining, revealed a copper strap which extended into the wall. The strap had left a green stain on the parge coat of the foundation wall, and appears to be the only extant portion of the lightning protection system.

Foundation

At the 1909 addition, the foundation walls above grade are not dressed stone like those at the 1874 section of the structure. They are, instead, rough stone placed in irregular coursing covered with a parge coat that is scored to resemble the more articulated 1874 foundation walls. Below ground, the walls had more similarity to the adjacent 1874 walls. In his archeological report written in 1990, Bruce Jones' findings support this saying that:

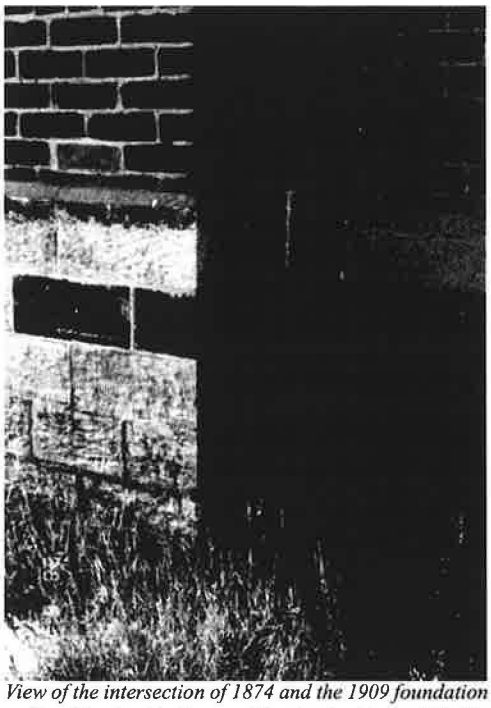
Figure 24

View looking southwest toward the Double Keepers' Duplex Residence (HS-11), June 1920. Note the lightning protection cable and downspout along the north elevation.

Figure 25

View of the north elevation of Double Keepers' Duplex Residence (HS-11) showing a dark stain on the brick surface, 1995.

Figure 26



View of the intersection of 1874 and the 1909 foundation walls of the Double Keepers' Duplex Residence (HS-11), 1995.

> ...like the original [1874] work, the addition foundation had no footing; the lowest course was composed of rounded beach cobbles and reddish-purple sandstone blocks bedded in mortar and laid in clean sand. Some of the sandstone blocks in the addition wall keyed into the lowermost courses of the original foundation. More regular sandstone and mortar masonry continued upward from the lowermost courses to roughly 130 cm (51 in) below surface where they were covered by a thin mortar parge coat. The parge continued upward to the base of a limestone sill [this is the portion that is tooled to resemble stone] below the brick masonry in the addition wall, roughly 1 m (3 ft) above the present grade.[22]

Figure 26 illustrates the intersection of the 1874 and the 1909 foundation walls at the south elevation of the building.

Construction Quality

The notion that the structures at the station were durable and of quality construction materials is again evident at the east porch. Bruce Jones observed several materials during his 1990 excavations near the porch, which suggest that there was a practice of 'over-

building' at the Au Sable Light Station due to an abundance of materials. He suggests in his findings that:

> ... the Au Sable station stored an ample stock of construction materials such as fasteners, a supply so great that heavy boat spikes could be essentially wasted on lighter construction. This may simply be another manifestation of the phenomenon observed in the area of the 1909-era porch at HS-11. In that instance the brickwork for the step piers and porch columns was much more substantial (and utilized many more bricks) than would have been necessary for the structural support of a light frame porch and two sets of wooden steps. Bricks were clearly not in short supply at Au Sable in 1909, and the evidence from the excavations around the F3 privy [east of HS-11, no longer extant above grade] suggests that the smaller structures at the station, including those built of brick, were routinely demolished rather than salvaged and/or moved to alternative locations on the Au Sable reservation. The quantity of heavy fasteners recovered from the site in 1990 may well be another reflection of the same attitude.[23]

This trend toward 'over-building' appears to be a characteristic of the Lighthouse Service, and may represent typical vernacular institutional design of the period as applied to unique equipment and remote rugged locations.

Tower (HS-10)

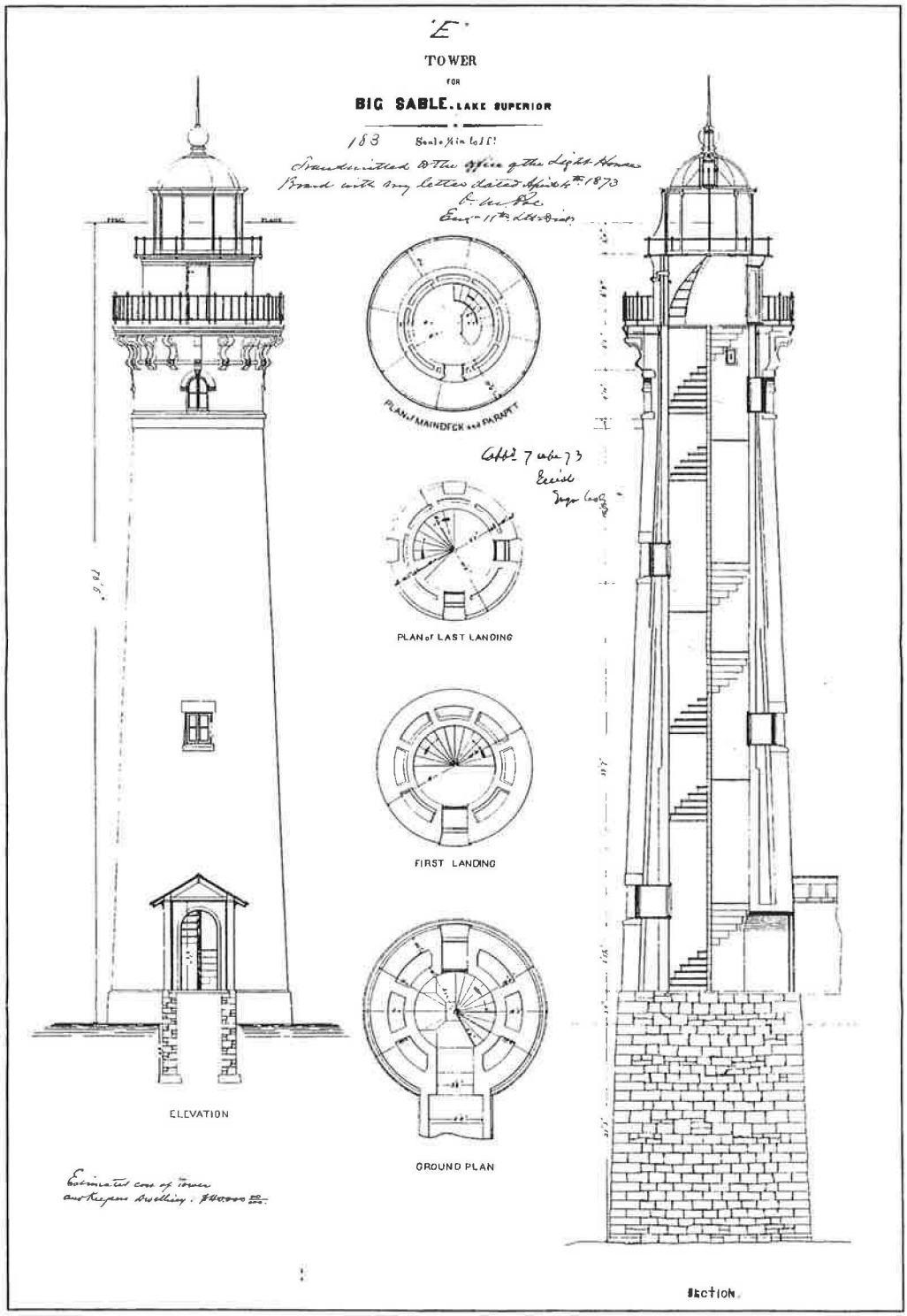
The light tower, which is connected to the Double Keepers' Duplex Residence (HS-11) by a brick passageway, is 18' - 3" in diameter at its base and tapers to 13' - 5" at the lantern room. The center space is a constant 8' - 0" diameter. The structure is comprised of two concentric walls which extend the full height of the tower. At the ground level, the two concentric walls are 20" thick (exterior) and 12" thick (interior) with a 2' - 0" air space, and at the lantern level taper to 16" thick and 8" thick with a 5" air space.

An interesting design feature of the tower is the false window opening located at the work room level. At the exterior, there appears to be four evenly spaced round top windows with decorative crowns. However, closer inspection reveals that one of the openings is actually only a recess in the outer brick wall. As a true opening, this window would not provide much light, and would be unsafe due to the proximity of the interior cast iron stairs which run right alongside of it. The construction drawings for the tower (**Figure 27**) indicate that the false opening was intended, and physical investigation confirmed, that this was an original feature. This feature was not unique to the Au Sable tower, however. The same false window (on the same tower design) can be observed at several other towers at Great Lakes light stations, including the tower at the South Manitou Island Light Station and the tower at Petite Pointe Au Sable Lighthouse, both on Lake Michigan.

Another interesting detail of the Au Sable tower is the presence of counterweight cabinets within the brick wall, one at the ground level and one at the workroom level, which are typical features of towers that had revolving lights. A shaft within the wall structure was utilized to hang the weights, which were wound at the bottom by the keeper. However, all known historic documentation states that Au Sable exhibited a fixed light. As part of a previous investigation, Douglas S. Walter, of the National Park Service, examined these cabinets in 1978 and concluded: "The many layers of paint that held the access door shut attest to many years of disuse, and then it was found that there was no shaft connecting the cabinet at the top platform with the one at the base of the tower. It is the author's opinion that a counterweight system was never used, since it would be impossible to use as constructed."[24] On the other hand, the 1909 *Description of Buildings, Premises, Equipment, Etc.* refers to a "drop tube," listed as 75 feet in length, which may be the wall shaft, signifying that it was actually constructed. However, in accordance with the fixed light exhibited at Au Sable, the description also states that, "The drop tube is not used."[25] The cabinets and adjacent walls had been restored and painted prior to the 1995 physical investigation, thereby hindering further physical investigation without subsequent damage to the interior finishes.

The Au Sable light tower was frequently struck by lighting, as its height and exposed metal surfaces made it an ideal target. While protected with a lightning cable leading down the tower from the deck of the iron platform into the ground, lightning still caused damage to the brick structure on more than one occasion. As early as 1893, a journal entry by the keeper states that, "During a Thunder Storm July 24th the Lightning struck the tower at 9 O'clock P.M. boring two holes in the bottom of the tower right at the foot of the Stairs, burning and damaging the paint in several places about [sic] the floor."[26] Several years later, in 1909, there was again damage, this time to both the Tower and the attached Keeper's Dwelling, as stated in a letter from the district engineer to the chairman of the Lighthouse Board.

Figure 27



Original construction drawing for the tower at the Au Sable Light Station, 1873.

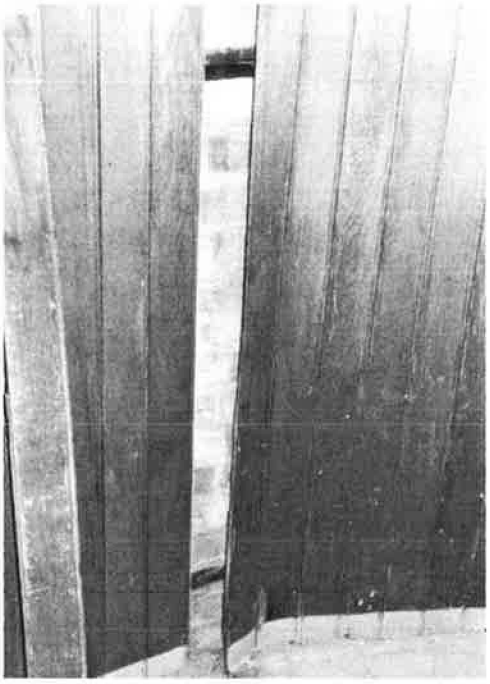
The letter says that a, "Severe electrical storm passed over here this morning doing considerable damage to present main dwelling the lower part of tower inside being cracked by concussion. The brick wall on the west beds is cracked and thrown out in places the north east upper corner brick wall thrown out. No one hurt."[27]

A June 22, 1935 description of the Au Sable Light Station, states that the "watchroom is paneled [sic] with oak."[28] **Figure 28** reveals that wood nailers were placed within the brick coursing of the inner wall to provide the nailing surface necessary for the wood wainscot, a common construction detail of the 19th century. A photograph taken during the 1990 physical investigation by Enviroscience, Inc., (**Figure 29**), reveals that at that time, prior to any manipulation of the space by the National Park Service, the bottom few inches of the wainscot boards were painted. This paint gave the appearance of a baseboard, while the rest of the wood wainscot above was stained and varnished. Physical investigation revealed that this paint detail was removed prior to 1995.

Although Lighthouse Regulations recommended that all interior cast iron and other metal surfaces be painted black, there are historic references that the cast iron stairs of the tower were painted red. A keeper's journal entry of May 1928 states that the keeper was, "Painting red on [the] tower stairs."[29] The 1995 physical investigation revealed that the stairs were painted black, a finish re-applied by the National Park Service. The 'red' referred to in the keeper's journal may have been a rust-inhibitive primer which was later covered with black paint.

Historic photographs of the Au Sable Light Station taken in 1884 and the 1885 list of "authorized" paint colors found in the "Instructions to Lightkeepers" manual distributed by the U. S. Lighthouse Service suggest that the base of the tower's lantern was originally painted white, the gallery deck and supporting cast iron brackets were painted black or brown, and the decorative brick trim of the round top windows at the watchroom level were painted gray, as seen in **Figure 30**. However, all of the known historic photographs taken after 1909 indicate that for most of its history through the abandonment of the station in 1958, the exterior of the lantern was painted black or another dark color, distinguishing it as a separate element of the tower. Photographs taken in 1970 reveal that by

Figure 28



View of the wood wainscot in the lantern room of the tower, 1990. Note the wood nailers within the brick work.

Figure 29

View looking west toward the Double Keepers' Duplex Residence (HS-11) and the Tower (HS-10), 1995. Note the small acrylic lens and solar panel attachment at the parapet of the tower.

Figure 30

View looking southwest toward the original keeper's dwelling (HS-11) and the Tower (HS-10) prior to the addition and alterations, 1884.

this late date the lantern had been painted white again. This suggests that the Coast Guard must have whitewashed the lantern, in addition to the rest of the tower, for convenience (since the station was abandoned) sometime during the 1960s, likely as part of a minimal maintenance program at the station. In 1989, the National Park Service repainted the lantern black, as it had appeared in 1909 -1910. However, as seen in **Figure 29**, the National Park Service also painted the brick trim of the round top windows and the two decorative belt courses at the watchroom level black as well. All known historic photographs of the tower indicate that these features were never black. Instead, they always appear to be painted a medium to light gray color.

The most significant change for mariners passing along the shore of Lake Superior must have been when the characteristic of the light changed. From the day the lantern was first lit in 1874 through the introduction of electricity to the station in 1944, the Au Sable tower exhibited a fixed white light. However, according to a June 22, 1935 description of the station, "Electrification would enable the station to have a flashing characteristic [without the need for additional equipment such as flash panels]."[30] Beginning in 1944, electricity was generated in the Fog Signal Building (HS-16) and then run underground to each individual building as required. An underground electric cable led from the Fog Signal Building (HS-16) to the Tower (HS-10) and then was attached to the inside face of the tower wall. Gouges were carved into the brick wall to allow the cable to bypass the cast iron treads and landings of the tower stair. Further, as predicted in 1935, following the electrification of the light in 1944, its characteristic changed from a fixed to a flashing white light.

Construction of the Keeper's Dwelling (HS-09)

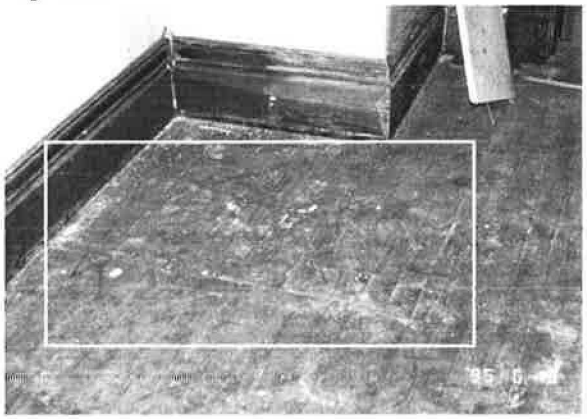
A second dwelling was constructed at the Au Sable Light Station in 1909 for the head keeper and his family. This dwelling (HS-09) is a two-story, single-family residence with a full basement and measures approximately 26' - 0" x 32' - 0." The dwelling has two entrances, each with a covered porch, one at the north elevation and one at the south elevation. There is a kitchen, dining room, and parlor at the first floor, and three bedrooms, and a bathroom at the second floor.

Interior

The "Historic Furnishings Study of the Au Sable Light Station," completed in 1981, discusses the interior finish treatment standards of the United States Lighthouse Service, stating that, "The [Lighthouse] Service specified that interior colors were to be gray and white. The walls and ceilings could either be painted dark gray (wainscot) or whitewashed. Hardwood floors and moldings were oiled and softwood floors were painted gray. Softwood baseboards and doors were painted white. All windows probably had dark green linen shades on spring rollers."[31] Evidence of these colors are evident throughout both the Keeper's Dwelling (HS-09) and the Double Keepers' Duplex Residence (HS-11).

Physical investigation revealed a dark stain on the floor boards at the northeast corner of the Kitchen (Room 104), as seen in **Figure 31**. This stain is the ghosted outline of an extension of the existing east kitchen wall, which originally extended the full width of the kitchen to the north wall, and had a door opening into a hall in front of the pantry. There is also a butt joint in the floor boards at what would have been the middle of the wall, a condition typical under partition walls. This north portion of the east wall, including a door, was removed

Figure 31

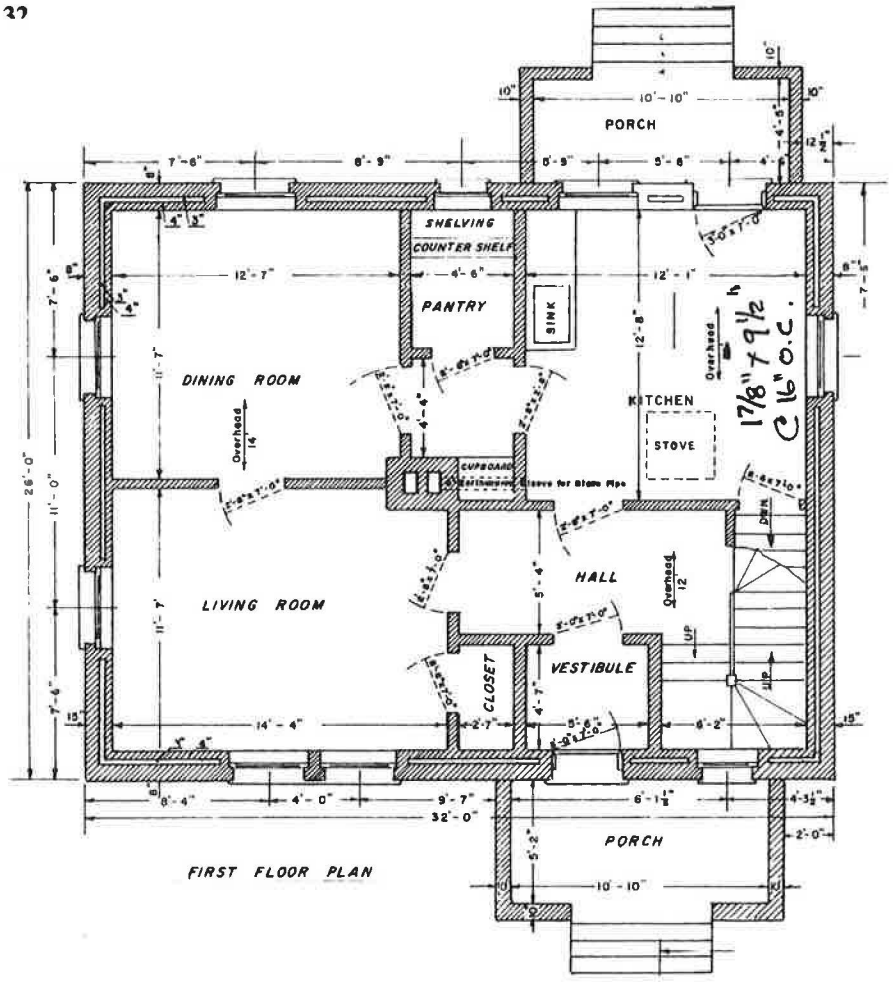


View of a butt joint in the floor, and a ghosted profile in the stain finish, at the northeast corner of the Kitchen (Room 104), indicating the former location of a wall.

and an arched soffit constructed across the span. Also demolished was a full height cupboard which was located between the wall and the chimney, which is shown at the center of Figure 32. Also indicated on Figure 32 is a 4" 'earthenware sleeve' which ran through the top of the cupboard for the stovepipe, and extended to the kitchen stove that was located near the center of the north kitchen wall. Both the wall and the cupboard were removed prior to 1949, because neither appear on a drawing of that year (Figure 33).

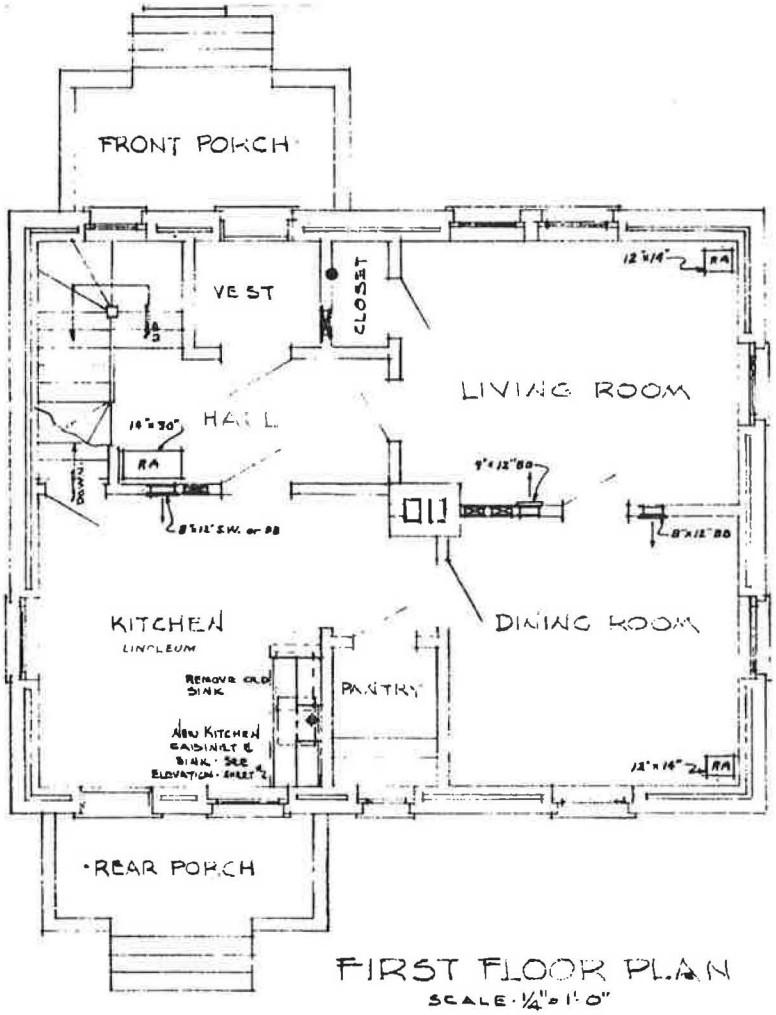
In earlier reports and discussions on the Au Sable Light Station, an assumption was made that the bathroom at the Keeper's Dwelling (HS-09) was an original feature of the structure. However, even though the room itself was original to the 1909 construction, the bathroom

Figure 32



The construction drawing for the first floor of the Keeper's Dwelling (HS-09). Although undated, it is assumed that this drawing was completed in 1908, as that is the date on the corresponding elevation drawings.

Figure 33



Drawing for modifications to the first floor of the Keeper's Dwelling (HS-09) which includes the installation of central heating. Drawn in 1949 with revisions in 1950.

fixtures were not installed until 1939. Prior to that time, the room was presumably used as a storage space. The construction of a privy (HS-14), in conjunction with the construction of the dwelling, further implies that there were originally no toilets within the structure itself. However, the space may have been intentionally designed as a bathroom, even though the technology wasn't implemented until several years later. A 1935 description of the complex, (four years prior to the installation of bathroom fixtures), already states that there was a "...room laid out for a bathroom on [the] second floor."[32] In addition, physical investigation revealed wood partitions, not part of the original construction, enclosing the plumbing lines. These enclosures are located in the closets, one at each floor, adjacent to the east wall of the bathroom. The enclosure partition is diagonal in the first floor closet, 101A, and rectangular in the second floor closet, 201A.

Beginning in 1949, efforts were undertaken to update both of the dwellings (HS-09 and HS-11) at the station with central heating, presumably an amenity long awaited by this isolated station. Along with the installation of a gravity heating system in both dwellings, the attic floors of both structures were insulated to increase heat efficiency. The 1995 physical investigation revealed several 12" x 16" openings cut through the wood baseboard at the interior walls of the Keeper's Dwelling (HS-09), as seen in **Figure 34**, which were air distribution grilles. Floor grilles were located at the outside corners of the rooms to allow cooler air to fall back down into the basement. Physical investigation

also revealed two areas, exposed by missing plaster, where the wall plate had been cut away to allow ductwork to run to the second floor within the partition wall framing. One of these exposed areas is at the north kitchen wall and is shown in **Figure 35**.

The coal room was constructed in the southeast corner of the basement in 1919. Its interior walls are unpainted, concrete block with a top course of large, yellow bricks, of a type which are unique at the station. A second type of brick found at the complex, which is an orange-yellow color, is seen in the window opening along the south wall of the coal room. It was used to fill in the excess opening around the coal chute, which was also installed in 1919. Although this orange-yellow brick was used at the interior of the opening, the opening at the exterior face is infilled with a red vitrified brick almost identical to the adjacent original brick, as seen in **Figure 36**. It is quite possible that the interior brick was surplus material from another Great Lakes light station and a Lighthouse Service tender delivered it, in conjunction with a routine visit, to the Au Sable Light Station. Finally, another interesting find in the coal room, as observed during the 1995 physical investigation, was that the coal which was being stored in the coal room at the time the station was abandoned in 1958, was left there, and hasn't since been removed.

Figure 34

Detail view of an opening cut into the baseboard, which is the previous location of an air distribution register in the Keeper's Dwelling (HS-09).

Figure 35

View of the exposed framing at the top of the north wall of the Kitchen (Room 104), 1995. Note that the top plate has been cut and removed to allow ductwork to extend to the second floor.

Figure 36

Detail view of the coal chute along the south elevation of the Keeper's Dwelling (HS-09), 1995. Note that the brick used to infill around the chute is almost identical to the original brick.

Exterior

Most of the windows of the Keeper's Dwelling (HS-09), have one-over-one double-hung wood sashes. This appears to be an original detail, in keeping with the standardization that the Lighthouse Service sought to achieve at all of its dwellings for easy and cost-effective window repairs and replacement. However, at the same time, ornamentation was incorporated into the building consisting of a diamond muntin pattern at four of the dwelling's windows. These windows included the two attic dormer windows, Window 2-7 (on the west

Figure 37

View looking southeast at the Keeper's Dwelling (HS-09) with the Tower (HS-10) and the Double Keepers' Duplex Residence (HS-11) in the background, June 1920.

Figure 38

The north elevation drawing for the Keeper's Dwelling (HS-09), showing the window types.

elevation), and Window 2-6 (at the north elevation). **Figure 37** of 1920 reveals the decorative muntin pattern at the top sash of Window 2-7, which is no longer present. The diamond muntin pattern in the bathroom casement window (Window 2-6), is indicated on the construction drawings of the dwelling (**Figure 38**). The only windows in which the diamond muntin pattern sash remained during the 1995 physical investigation were the two attic dormer windows.

Related Outbuildings

Fog Signal Building (HS-16)

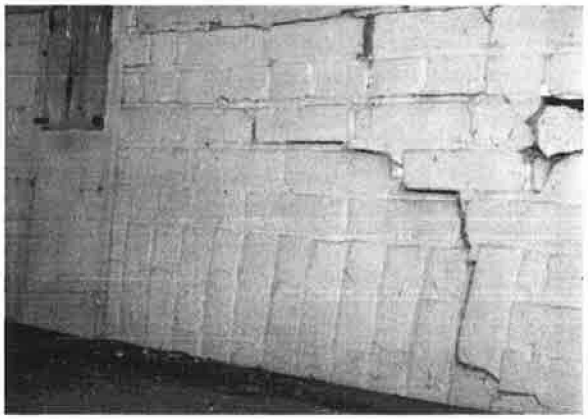
The Fog Signal Building was constructed in 1897. Its walls are common red brick and are 15" thick. Historic drawings indicate that the walls have the same construction detail as the walls of the Keeper's Dwelling (HS-09), consisting of two outer brick wythes and one inner wythe, with a 3" air space between the inner and outer wythes. There is a three course high brick ledge which protrudes approximately 1" from the brick face of the wall just above present grade, and extends around the entire perimeter of the building. Above this ledge, the bricks are laid in stretcher bond. Below this ledge, however, the brick foundation walls are laid in common bond, as noted by Bruce Jones following an excavation he performed along the south wall of the structure in 1990. Jones states that:

> ... the base of the foundation as formed by a 5 to 8 cm. thick (2-3 in.) mortar and brick rubble footing which appeared to have been laid on sterile sand. The footing protruded 10 - 15 cm. (4 - 6 in.) outside the subsequent courses of brick and probably reflects the dimensions of a trench 20 - 30 cm. (8 - 12 in.) wider than the probably 8 - in. thick wall which rested on it. Sixteen courses of brick were subsequently laid atop the footing in American common bond, with a first course of headers and multiple intermediate stretcher courses.[33]

All of the window and door openings of the Fog Signal Building (HS-16) are supported by brick arches at the exterior, a detail common to brick fog signal buildings at Great Lakes light stations. However, at the interior, the openings are supported by jack arches, one of which, at the north door opening, has begun to fail and has cracked, as shown in **Figure 39**. Several keepers journal entries also indicate that both screens and storms were used at the door and window openings, depending on the time of year.

David Clary states in his publication entitled, *The Life of the Keepers as Reflected in Their Official Journals*, that,

Figure 39



Detail view looking at the interior jack arch which has failed above the north door opening in the Fog Signal Building (HS-16), 1991.

Figure 40

View of the west elevation of the Fog Signal Building (HS-16), prior to the construction of the brick chimney in 1904. Note the duplicate steam whistles and steam stacks.

> The [presence of the steam fog signal] multiplied the maintenance responsibilities of the keepers to a remarkable degree. The [keepers'] journals indicate that throughout the 20th century the fog signal accounted for more of the men's time as it grew in navigational importance. Ships became larger and avoided the coasts. The light was often of less service to them than the signal that could alert them to the proximity of the fog-shrouded shores.[34]

The fog signal, thus, became an important element of the light station and one of the most important responsibilities of the keepers.

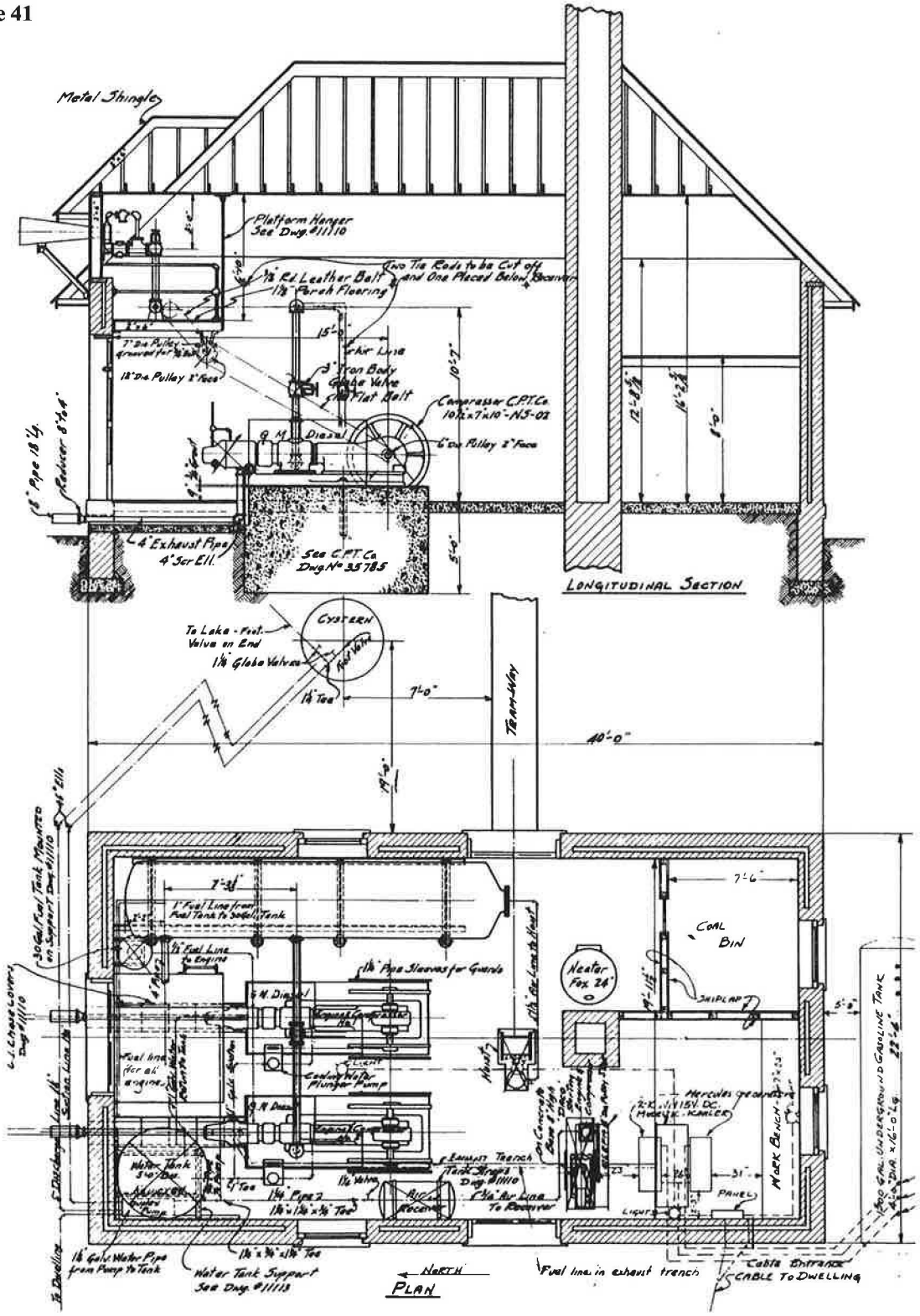
As the characteristic of each station's light was unique, so too was its fog signal. Au Sable's fog signal consisted of a blast of three seconds duration with an interval of seventeen seconds of silence between each blast. As originally constructed, the Fog Signal Building (HS-16) had two duplicate vent stacks and steam whistles, as shown in **Figure 40**. In addition, at the interior of the building, there were two duplicate boilers which produced the required steam. **Figure 40** also reveals that the roof was covered with wood shingles at that time, prior to the installation of metal shingles several years later. All necessary equipment was installed in duplicate as a precaution against any period of time needed to repair equipment.

In 1928, the fog signal was changed from a steam and whistle system to an air diaphone system, which was run by diesel generators and an air compressor. This significant change was noted on the inside cover of the journal kept at the station by Keeper K. L. Hamringa, which read, "Air compressor Installed, October 1928."[35] The installation of a platform which hung from the ceiling to support the air horns was typical of the installation of air diaphone equipment in fog signal buildings around the Great Lakes. A large dormer was also constructed above the platform to provide the additional height required, and to support the horns. Both air horns at Au Sable extended out of openings in the north face of the dormer, as indicated on **Figure 41**. These openings were covered over with plywood and sheet metal when the air diaphone system was removed in 1958.

Figure 41, the drawing for the installation of the air diaphone system, indicates a 'Coal Bin' at the southeast corner of the structure. The walls of the bin are indicated as wood frame with shiplap siding on both faces. It appears from this drawing that the coal bin was intended to be built in 1928, however, the area was probably already being used for coal storage several years prior. Another interesting detail on **Figure 41** is the indication of an air line from the large, elevated air tank in the northeast corner of the building to the tram hoist, which was located in the center of the building. Apparently the tram hoist was also run by air compression following the installation of the air diaphone system.

Equipment needed to electrify the station was installed in the Fog Signal Building in 1944, and is indicated by the 1949, 'As Built,' additions in **Figure 41**. Both of the dwellings and the light tower, in addition to the Fog Signal Building, were wired for electricity. Electricity was fed to the dwellings and tower by underground lines. **Figure 41** indicates that the line that led to one

Figure 41



Construction drawing for the installation of the air diaphone system and other alterations to the Fog Signal Building (HS-16), 1928. Revisions were made to the drawing in 1949.

of the dwellings exited the structure at the west end of the north elevation, and the other exited near the south end of the west elevation.

A brick chimney was constructed at the Fog Signal Building (HS-16) in 1904, replacing the duplicate metal stacks. Originally, the chimney extended to a height of 40' - 0", as seen in **Figure 42**, and the chimney remained following the installation of the diaphone system in 1928, as seen in **Figure 43**. However, part of it was removed in 1954, reducing it to its current height of approximately 3' - 0" above the roof line. Further, historically the Fog Signal Building's roof was covered with red pressed metal shingles. Following its acquisition of the Au Sable Light Station, the National Park Service replaced the shingles with asphalt ones as part of the stabilization of the structure. However, the metal shingles were stored for future use.

Previous physical investigation by Douglas Walter in 1978 revealed the openings in the roof sheathing from the former metal stacks and whistles. The metal eye bolts at the edge of the building's eaves, to which the guy wires that braced the metal stacks were attached, remain extant, as seen in **Figure 44**. **Figure 44** also reveals metal plates and bolts along the east elevation. These plates, which appear in historic photographs only after the installation of the air diaphone system, probably support part of the diaphone system loft platform. The height of the bolts and plates and their installation only along the north half of the east elevation are consistent with the platform for the air receiving tank shown on the diaphone system installation drawings (**Figure 41**).

As part of the unmanning of the entire Au Sable Light Station, the fog signal was put out of operation and most of the related equipment removed in 1958. **Figure 45** shows the interior of the Fog Signal Building (HS-16) in 1991, revealing that the only remaining equipment in the building at that time was an air tank on an elevated support frame in the northeast corner of the building, and the platform for the air horns with its ladder to the ground. As was the case throughout the Au Sable Light Station, following the departure of the Coast Guard in 1958, maintenance was not a priority and for several years the Fog Signal Building (HS-16) gradually deteriorated as shown in the photo (**Figure 46**) taken in 1970.

Figure 42

View of the Fog Signal Building, June 1920. Note the brick chimney, which was constructed in 1904.

Figure 43

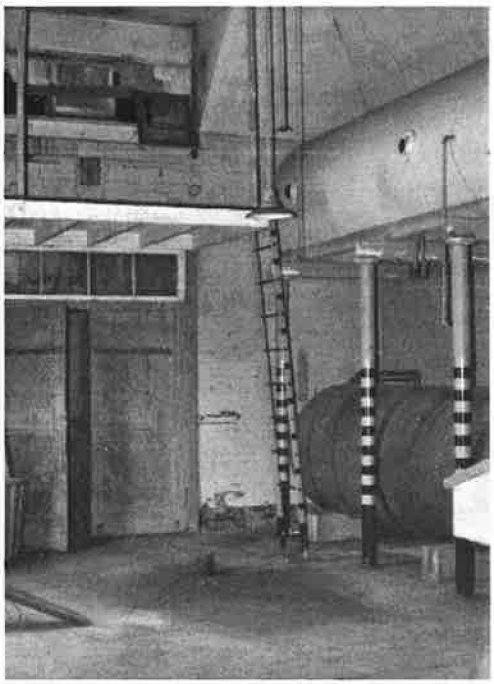
View looking down from the Tower (HS-10) toward the Fog Signal Building (HS-16). This photograph, dated 1950, shows the changes to the Fog Signal Building following the installation of the air diaphone system in 1928. Note that the general appearance of the Fog Signal Building (HS-16), the Boathouse (HS-17) and the concrete walks connecting the structure look relatively the same as they do today.

Brick Oil House (HS-13)

Figure 44

View of the east elevation of the Fog Signal Building (HS-16), 1995. Note the metal eye bolts (circled) used tie down the guy wires that braced the metal chimney stacks.

Figure 45



Interior view looking northeast in the Fog Signal Building (HS-16), 1991. Note the suspended platform and air tank, some of the remaining equipment from the air diaphone system used from 1928-1958.

Figure 46

View looking northeast toward the Fog Signal Building (HS-16), 1970. Note the deteriorated condition of the structure, including missing shingles, deteriorated mortar and bricks, and remnants of electrical conduit.

By 1877, the U. S. Lighthouse Service had begun to convert the primary fuel at light stations across the country to kerosene because it provided better illumination than the previous fuel, which was lard oil. By 1885, kerosene was the principal fuel used to illuminate lights nationwide. It was in use at least as early as 1882 at Au Sable, as evidenced by a keeper's journal entry of that year, stating that, ".. the Steamer Dahlia visited Big Sable Light Station ... and Furnished us with supplies and new Kerosene Lamps."[36]

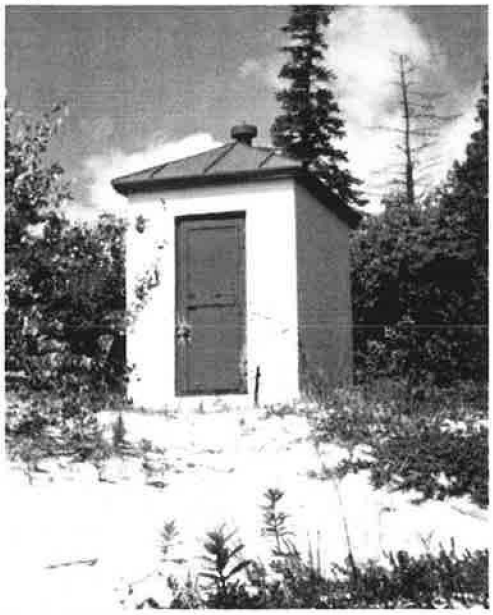
The transition, from lard oil to the more flammable kerosene, led to the need for safer storage areas. At Au Sable, the lard oil had previously been stored in a designated room of the Double Keepers' Duplex Residence (HS-11) adjacent to the passageway, which was easily accessible to the tower. After the conversion from lard oil to kerosene, it became typical at most light stations to store the highly flammable kerosene in the basement of the dwelling, which was plastered to provide a fireproof separation between the oil storage area and the living spaces upstairs. Although the basement was not plastered at Au Sable, the cellar of the Double Keepers' Duplex Residence (HS-11) was divided into two separate spaces with the construction of an 8" thick masonry wall in 1888, allowing half of the basement to be used for kerosene storage. Finally, the concern for safety led to the construction of storage areas which were completely separate from the dwellings. These storage areas, otherwise known as brick oil houses, began to be constructed at several Great Lakes light stations during the end of the nineteenth century. The

brick oil house (HS-13) at the Au Sable Light Station was constructed in 1895.

With the tremendous and rapidly growing need for brick oil houses around the Great Lakes, a standard design for their construction was developed. As a result, many of the oil houses in the region share similar architectural characteristics. However, as was common, the basic standard design was often modified, allowing for slight variations at each station, usually based on the availability of materials. Although all of the oil houses of this period were constructed of brick, the type of brick varied. Typically, the bottom few brick courses protruded creating a plinth around the perimeter of the structure just above grade. The structures also typically had metal doors with stone or concrete sills and floors, and a metal roof vent, as seen in **Figures 47, 48, and 49**. Lighthouse Service construction crews traveled to the various stations, constructing the oil houses within a few days' time. An 1895 keeper's journal entry from Au Sable reads, "Steamer Warrington arrived at the Station on the 14th of May with Matarial [sic] for oil House, also two mens [sic] for erecting same. Mens [sic] finished work on the Oil House on the 22nd of May."[38]

The Au Sable brick oil house is constructed of red brick laid in stretcher bond with a metal hip roof. An excavation performed in 1990 revealed that the con-

Figure 47



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

Figure 48

Brick Oil House, Raspberry Island Light Station, Lake Superior, 1995.

Figure 49

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

struction of the structure's walls below grade were of lesser brick quality, a characteristic of most of the structures at the Au Sable Light Station. Following his excavation, Bruce Jones states that:

> A great many imperfect bricks were used in construction of the subsurface wall, and below grade the mortar thickness varied considerably around a mean of 1/2". The subsurface wall rose 75 cm. (29 1/2 in.) and ten courses from the footing to the base of a poorly laid, one-course thick, brick ledge which protruded discontinuously 1 -3 cm. (1/2 to 2 in.) from the sub-surface and above ground wall.[38]

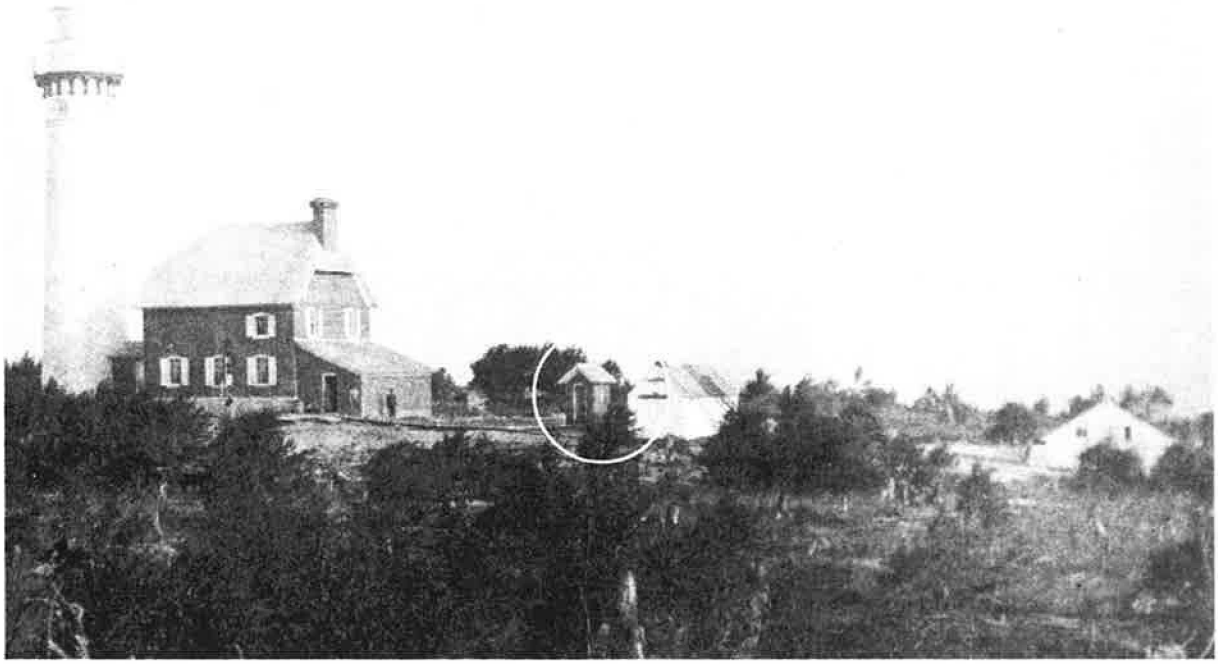
The metal hip roof and center vent of the structure are painted red. This has probably always been the case as several exterior metal surfaces, especially metal roofs at the light stations, were typically painted red by stipulation of Lighthouse Service standards. The riveted metal door is located on the north elevation and it appears that its paint color has changed. A keeper's journal entry of June 1930, states that the keeper was, "Painting Black on [the] Oil House Doors..."[39] However, physical investigation revealed several layers of white paint, in addition to historic photographs in which the door appears light in color.

Privies

During its history, the Au Sable Light Station had three brick privies. It is assumed that the first privy, as seen in **Figure 50**, just east of the original keeper's dwelling (HS-11), was constructed in conjunction with the dwelling in 1874. Physical investigation conducted in 1995 revealed no surface expression of this privy. However, a second privy (HS-15), which later served the same original keeper's dwelling (HS-11) after it was converted into a duplex, remains south of the dwelling. The construction date of this second privy (HS-15) is not currently known, although it is assumed to be circa 1909.

The existing privy (HS-15) presumably served the Double Keepers' Duplex Residence (HS-11) from 1909 until the installation of indoor plumbing in 1939. The privy's gable roof is covered with stamped metal shingles which have a pressed pattern that differs from that of other shingles at the complex. Along the ridge, there is a metal ridge roll similar to the one at the Double Keepers' Duplex Resi-

Figure 50



View looking northwest of the Au Sable Light Station as it appeared in 1884. The privy is circled.

Figure 51

View of the south elevation of the Brick Privy (HS-15) which served the Double Keepers' Duplex Residence (HS-11), 1995.

Figure 52

View of the north elevation of the Brick Privy (HS-14) which served the Keeper's Dwelling (HS-09), 1995.

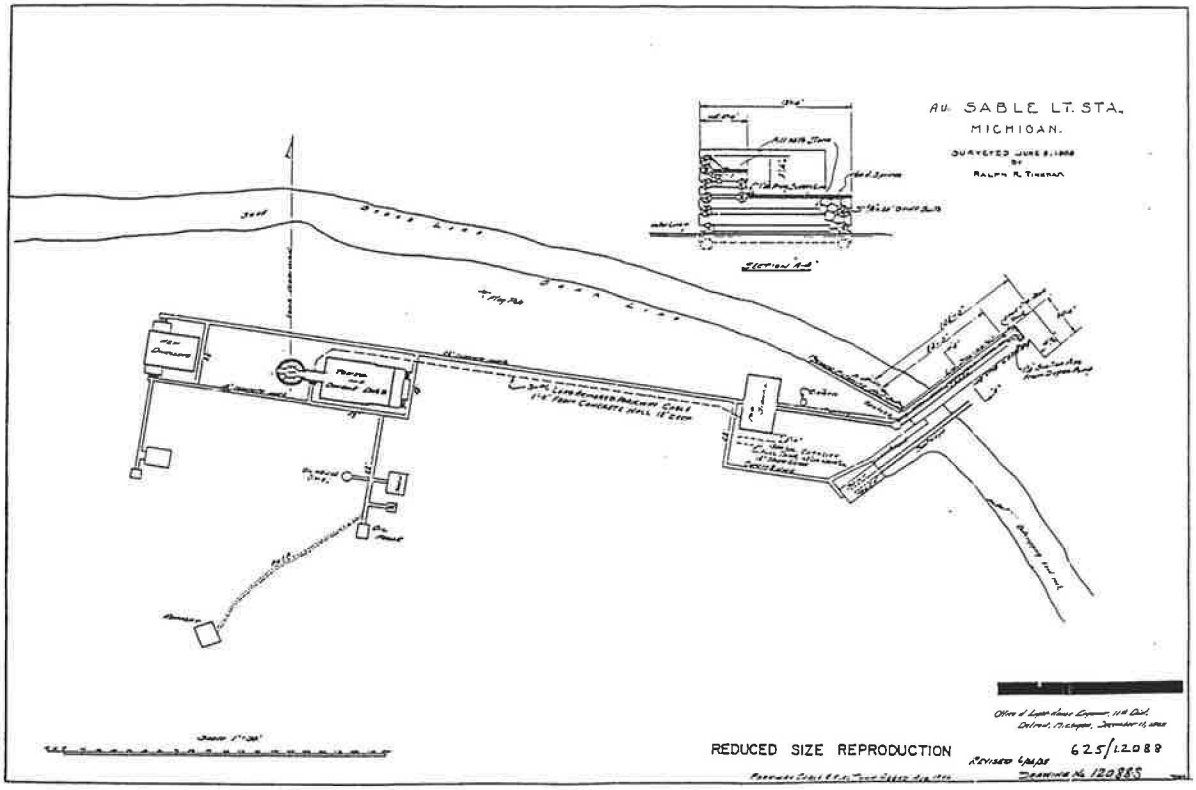
dence (HS-11). At the center of the ridge is a wood vent stack with an elaborately carved cap. The walls of the structure are brick, laid in stretcher bond, with a plinth that rises three courses above grade around the perimeter of the structure, a detail typical of all of the brick outbuildings at the complex. The privy appears to have been painted according to the Lighthouse Service standards, with all exterior metal surfaces painted red and all wood painted white. The privy has one door opening, which is on the west elevation and is supported by a jack arch and has a concrete sill. There is also one window on the structure, at the south elevation, which is also supported by a jack arch and has a concrete sill, as seen in **Figure 51**.

The third privy (HS-14), also extant, served the newer Keeper's Dwelling (HS-09), and was constructed of the same vitrified red brick as the dwelling. The brick is laid in common bond with five courses of stretchers between each header course. The door is located on the north elevation, facing the path from the Keeper's Dwelling (HS-09). There is an unusual brick pattern at each side of the door, consisting of three headers, as seen in **Figure 52**. The hip roof has pressed metal shingles identical to those of both dwellings. There is a window with a concrete sill and lintel on the west elevation. As seen at the other privy (HS-15), the exterior paint colors are in accordance with Lighthouse Service standards.

Although not accessible during the 1995 physical investigation, historic documentation suggests that the interiors of both privies (HS-14 and HS-15) were historically whitewashed. A keeper noted in his journal entry of June 1925 that he was, "White washing [the] Oil house and oute [sic] house in side [sic]."[40] It was standard practice to whitewash the interior of secondary buildings and spaces at the light stations as it was less expensive than painting with lead, yet it still provided a bright, clean appearance to these poorly lit structures.

It was previously assumed that the original privy, its archeological remains referred to as (F3), was relocated in 1909 and is actually either HS-15 (the second privy mentioned) or HS-14 (the third privy mentioned). Bruce Jones disputes this theory based on the analysis of excavations he performed at the extant privy (HS-15), south of the Double Keepers' Duplex Residence (HS-11), and at the site of the original privy (F3). He states that:

Figure 53



Ralph Tinkham's 1909 survey drawing of the Au Sable Light Station by Tinkham, drawn in conjunction with an official U.S. Lighthouse Service description of the station. Revisions were made to the drawing in June 1935.

> ... no structural evidence was exposed which suggested that HS-15 had been moved to its present site from a prior location. [and] While HS-14 and HS-15 are almost identical in above-ground horizontal dimensions. The F3 privy footprint is clearly a different size and the structure could not have been simply moved to the site of HS-14 or HS-15 and reset upon their subgrade foundations.[41]

Regardless, the privy situation was altered prior to the drawing of Ralph Tinkham's map in June of 1909 (**Figure 53**). The 1935 revisions are additional structures, not deletions. A logical assumption is that the second privy (HS-15) was constructed in conjunction with the conversion of the original keeper's dwelling into the Double Keepers' Duplex Residence (HS-11) in 1909. Thus, the original (F3) privy became excess and was subsequently torn down.

Metal Oil House (HS-12)

The metal oil house (HS-12) was installed in 1915 to provide a safe environment for the storage of surplus flammable materials. This type of fireproof structure was quite common at both light stations and at life-saving stations around the Great Lakes, and was often referred to as a 'paint locker'. However, as noted in keepers' journal entries at Au Sable, this particular metal oil house also stored kerosene. In his journal entry of July 1919, the keeper states that he was, "Whealing [sic] oil and storing it in oil houses."[42]

Although there is no historic photographic evidence, 1935 revisions to Ralph Tinkham's 1909 map of the Au Sable Light Station (**Figure 53**) indicates that the metal oil house was originally located slightly north of its current location, directly west of the 1903 wood frame structure. However, surface expression of a concrete walk or foundation slab was not observed in this location during physical investigation.

Although the interior of the structure was not accessible during the 1995 physical investigation, it was observed by Douglas Walter of the National Park Service in 1978. He states that, "The roof is of double construction, with an inner and outer layer, [each layer

Figure 54

View looking northeast toward the Boathouse (HS-17), 1970. Note the wood shingles.

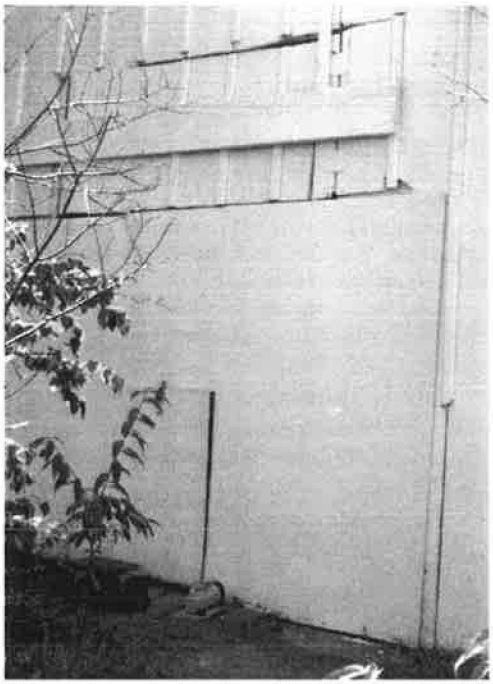
comprised of six riveted triangular panels], and the walls have an inner layer of brick for fire protection... Built-in shelving follow the walls' curvature, and the floor is concrete."[43] There is also a metal vent at the center of the roof. There is only one known reference to the historic paint color of the structure, a journal entry of 1927 in which the keeper states that he was, "Painting Green on Signal also Round Oil House..."[44] Presumably this was a light green, since in most historic photographs the structure appears very light in color. Furthermore, the structure was painted a bright yellow during the 1995 physical investigations, and it is not currently known whether this color has historic precedence.

Boathouse (HS-17)

The first boathouse at the station is assumed to have been constructed in conjunction with or shortly after the construction of the original keeper's dwelling (HS-11). The first photographic evidence of the boathouse is a historic photograph of 1884, **Figure 50**, revealing that the although the boathouse is in relatively the same location as it is today, it was of slightly different proportions and had two windows at the south elevation.

There have been several indications, in earlier reports, that the boathouse had been relocated and possibly rebuilt at least once during the history of the lighthouse,

Figure 55



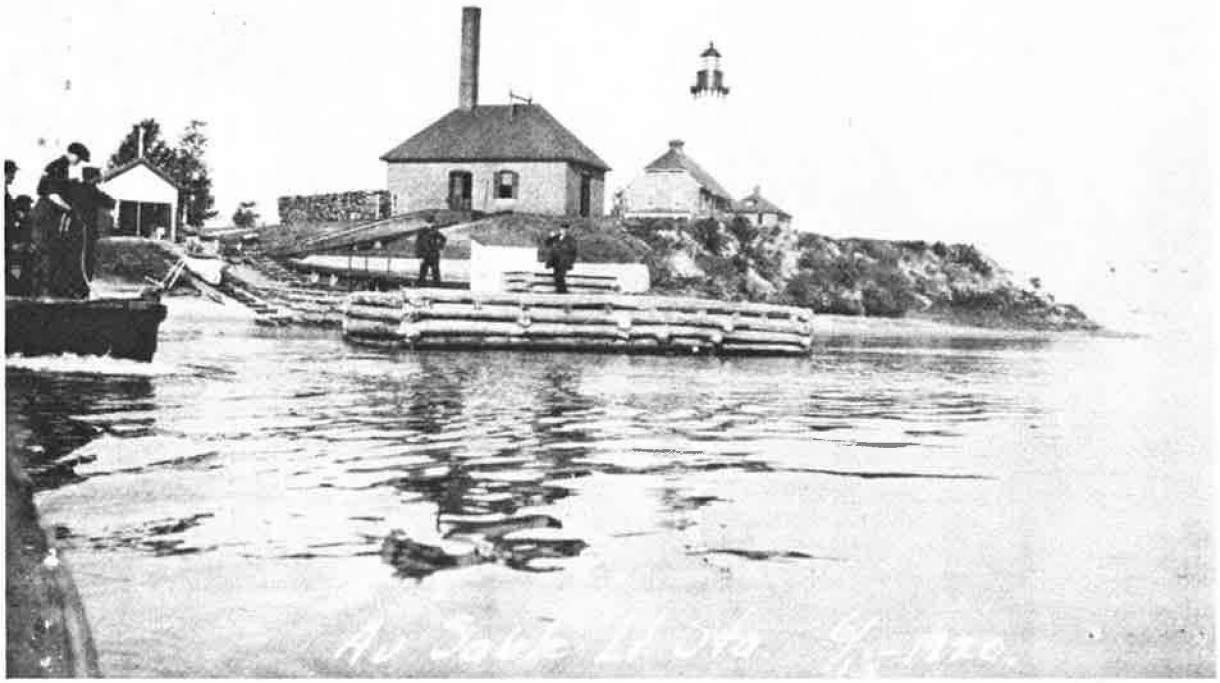
View of the north elevation of the Boathouse (HS-17), 1991. Note that the main portion of the large swinging door is covered with plywood, and only the raised top portion of the door is visible.

although no written documentation of such alterations were found to confirm these assumptions. Previously, Enviroscience, Inc. stated that a keeper's journal entry of 1901 recorded the relocation of the structure, however, this information was not located by Quinn Evans/ Architects. The current boathouse is a wood frame structure with board and batten siding, painted white. The 1909 *Description of Buildings, Premises, Equipment, Etc., at Au Sable Light-Station, Etc.* states that at that time the exterior of the structure was painted an olive green. Furthermore, the *Description of Buildings, Premises, Equipment, Etc., at Au Sable Light-Station* also states that the boathouse at that time had a red shingle roof. There is no photographic or written evidence of this roof past 1909, however. A 1970 photograph, **Figure 54**, indicates that by this date the roof was covered with unfinished cedar shingles, and National Park Service records indicate that the roof was covered with asphalt shingles in 1976, which remain on the structure today. There is a large swinging door at the north elevation which provided the boat access into the structure, as seen in **Figure 55**. Apparently, the size of this door was enlarged sometime after 1938.

Additional Structures

Although no longer extant, there were several important elements and structures at the station that were essential to its operation and efficiency. The wood dock was one of the first things constructed at the site of the Au Sable Light Station, and continued to be an integral part of the station throughout its history including several periods of reconstruction and additions. An elaborate system at the dock area helped transport materials from the water up the embankment to the Fog Signal Building (HS-16). The system included: an extensive wood dock with a well box, pump, and pipe system, consisting of 202 foot long, 1-1/2" diameter pipes, installed alongside of it which drew water from the lake and transported it to the steam boilers in the Fog Signal Building (HS-16). The L-shaped dock is shown in **Figure 56** of 1935 and again under repair, a constant effort due to the damage caused by the lake, in **Figure 56** of 1935. Also at the dock area was a spherical cistern, which stored the excess water from the fog signal steam boilers, and was constructed in 1905; a marine boatway with a hoisting engine for hoisting the boat into the adjacent boathouse (HS-17); and a tramway with a turntable and a hoisting engine for

Figure 56



View looking southwest toward the Fog Signal Building (HS-16) and the Boathouse (HS-17) from the water, 1920. Note the elaborate system for unloading supplies and transporting them to the Fog Signal Building.

Figure 57

View of the station dock during repairs, September 1935.

transporting a tram full of supplies from boats at the dock to the east entrance of the Fog Signal Building (IIS-16). **Figure 57** shows the entire dock area as it appeared in 1920.

Garage (HS-09a)

For several years of its operation, the station remained isolated and was mainly accessible only by water. Further, accessibility to the station was often determined and dependent upon the unpredictable weather conditions of Lake Superior. Not until 1925 was an effort made to make land travel to and from the station more feasible. The keeper states in his journal entry of July 1925 that the, "Keeper and 1st asst [are] puting [sic] up a small Garage on the hill 2 miles from the station."[45] This was the closest that a road came to the station. Another 'road' between the garage and the station is referred to several times in keepers' journal entries, but it was only a foot path, quite a distance for the keepers to travel by foot with supplies. A June 22, 1935 description of the station states that, "[The] keepers have a car on the road 2 miles from the station and walk over a trail through the woods and swamp to reach the car."[46]

The road along which the garage was located was built by the Civilian Conservation Corps and ran from Grand Marais west, coming nearest to the Au Sable Light Station near the mouth of the Hurricane River, a distance of approximately 2 miles. An extension road, running form the CCC road to the station, was presumably begun by the Lighthouse Service in the mid-1930s and finished by the Coast Guard who acquired the station in 1939, thus the road has been historically referred to as the "Coast Guard Road". The extant wood frame garage on the site of the station was not built until 1954. The original drawings for the garage indicate that its two overhead doors were to be located on the north elevation. However, as built, the doors are located on the south elevation, facing the drive which leads from the Coast Guard Road. The south face was presumably chosen because it provided more shelter from the often strong lake winds.

Wood Frame Structures

Historic photographs and written documentation of the Au Sable Light Station provide evidence that four additional wood frame structures existed at the station, but none of them are extant today. The first wood frame structure appears in a historic photograph of 1884 (**Figure 50**), which indicates that the structure was located

Figure 58

View looking northwest toward the light station. Note the dark trim on the white wood frame structure just north of the privy (HS-15), 1920.

just east of the original keeper's dwelling (HS-11) near the first privy. This frame structure, the exterior of which was painted white, presumably served as a storage shed, and particularly as a woodshed following the conversion of the one-story wing attached to the dwelling from a woodshed into a kitchen. The wood frame structure was removed from the site, however, prior to 1935, as it does not appear on the 1935 revision to Ralph Tinkham's 1909 site plan of the station.

The second wood frame structure to appear at the site is presumed to have been built in 1903. It was located just south of the original keeper's dwelling (HS-11) near the brick oil house (HS-13), which had been constructed in 1895. These two structures, in addition to the brick privy (HS-14) built in 1909, and the metal oil house (HS-12) built in 1915, were clustered in a small area. **Figure 58** reveals that the frame structure had a brick chimney along the south wall and a six-pane window on the east elevation. A keeper's journal entry of 1919 states that he was "Building [a] Coal bin [and] Cleaning up wood house."[47] This entry suggests that at least one of the two wood frame structures extant at that time was used as a woodshed. Furthermore, the 1909 *Description of Buildings, Premises, Equipment, Etc. at Au Sable Light-Station* states that the dimensions of the extant woodshed at that time were 12' x 14' x 9' which appears to be approximately the same as those of the structure in **Figure 58**. The description also states that the frame structure was "buff with green trim and [had a] red metal slate hip roof."[48]

The third wood frame structure to be constructed at the station was located south of, and likely in conjunction with, the construction of the new Keeper's Dwelling (HS-09). This wood frame structure was located adjacent to the brick privy (HS-14), thus the two structures formed a smaller version of the cluster of outbuildings located south of the Double Keepers' Duplex Residence (HS-11). The *1909 Description of Buildings, Premises, Equipment, Etc. at Au Sable Light-Station*

Figure 59

View looking north toward the Keeper's Dwelling (HS-09), August 1942. Note the features in this photograph which are no longer extant, such as the telephone poles and line, and the board-and-batten wood frame storage shed south of the Keeper's Dwelling.

Figure 60

Aerial view of the light station, looking southeast, circa the late 1940s.

states that the structure was, "a 12' x 16' shed, [with a] metal slate roof."[49] As seen in **Figure 59**, the structure had board and batten wood siding which was painted white. This photograph also reveals that there were two small, single-pane windows on the south elevation. **Figure 60** provides an aerial view of the Au Sable Light Station in 1954, and indicates that there was a door and two small windows on the north elevation, and an additional door on the west elevation of the structure. **Figure 59** also reveals a small vent stack near the east end of the roof ridge.

A keeper's journal entry of 1928 states that he was, "Painting Keepers [sic] wood shed."[50] By distinguishing that it was the keeper's woodshed, this entry suggests that both of the frame structures were being used as woodsheds. The maintenance and painting of the two wood frame structures appears to have been taken care of in unison. A keeper's journal entry of 1925, for example, states that he was, "Painting [the] wood sheds."[51] The next day, the keeper states that he was, "painting green on [the] wood sheds."[52] Based on historic photographs, including **Figures 58, 59, and 60**, the dark green wood trim did not appear until approximately 1920, although it is listed in the 1909 *Description of Buildings, Premises, Equipment, Etc., at Au Sable Light-Station*. By the early 1950s, however, the exterior of both structures returned to all white.

Presumably, both remaining wood frame structures were removed from the site in the 1950s. There is written documentation stating the demolition of the structure located south of the Keeper's Dwelling (HS-09). A keeper's journal entry of 1954 states that the, "Crew turned to tearing down woodshed at Officer in Charge's quarters."[53]

The remaining wood structure, a hennery, is documented only on Tinkham's 1909 site map. The map locates the hennery south of the Keeper's Dwelling (HS-09), accessed by a trail leading southwest of the Brick Oil House (HS-13). To date, there has been no archeological examination of a possible foundation site. Furthermore, there are no photographs or drawings.

Retaining Seawall

Shore erosion has threatened the stability of the Au Sable Light Station throughout most of its history. The first physical measure the Lighthouse Service undertook to provide shoreline protection was the construction of a stone and concrete seawall in 1906, which was located near and protected the Fog Signal

Figure 61

Detail view looking south toward the Fog Signal Building (HS-16) showing the deteriorated state of the concrete seawall, circa 1930s.

Figure 62

Detail view looking south toward the Fog Signal Building (HS-16) showing the deteriorated state of the concrete seawall, circa 1930s.

Building (HS-16). The Fog Signal Building's location near the shoreline and dock made it the most susceptible to erosion-induced structural damage. Several of the keepers' journal entries indicate the constant deterioration and subsequent numerous repairs needed at this seawall following its construction, (**Figures 61 and 62**). By 1942, 85% of the wall had collapsed into the lake.[54] That same year extensive repairs were again undertaken, including a 63' westward extension of the wall, which made the wall approximately 130' total in length. Unfortunately, the harsh forces of the lake continued to deteriorate the wall, and by the 1995 physical investigation, only a few small concrete remnants remained of the wall. Shoreline protection in this area is now provided by a timber seawall constructed by the National Park Service in 1976.

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1 Mark F. Pfaller Associates, Inc., *Historic Furnishings Study, Au Sable Lighthouse, Pictured Rocks National Lakeshore* (Milwaukee, WI: 1981), 89.

2 Mark Chavez, *Historic Structures Report, Chapter VIII, Au Sable Lighthouse Complex, Pictured Rocks National Lakeshore, Michigan*. Prepared for the U.S. Department of the Interior, National Park Service, Midwest Regional Office (1994), 7.

3 Mark F. Pfaller Associates, Inc., 1.

4 Chavez, 7.

5 Ibid., 7.

6 Louis Torres, *Historic Structure Report, Historical Data, Au Sable Light Station, Pictured Rocks National Lakeshore, Michigan*. Prepared for the U.S. Department of the Interior, National Park Service, Historic Preservation Division, Denver Service Center, Denver, Colorado (November 1978), 47-50.

7 Ralph R. Tinkham, *Description of Buildings, Premises, Equipment, Etc., at Au Sable Light-Station, Michigan, June 7, 1909*, Record Group 26, United States Coast Guard, Bureau of Lighthouses, 1911-1939, National Archives, p.7.

8 Rachel Franklin Weekley, "Notes Taken by Rachel Franklin Weekley [from] Record Group 26: Records of the U.S. Coast Guard, Records of the Lighthouse Service. Lighthouse Station Logs, 1897-1941. Ashtabula, 1934-1940 Thru Baker's Island, 1931-1939," July 1994, National Archives, p.7.

9 Chavez, 11.

10 Ibid., 11-12.

11 Ibid., 5.

12 Ibid., 13.

13 Mark F. Pfaller Associates, Inc., 1.

14 Chavez, 8.

15 Bruce A. Jones, *Evaluative Investigations at the Au Sable Light Station, Pictured Rocks National Lakeshore, Michigan, 1990* (Technical Report No. 32). Prepared for the U.S. Department of the Interior, National Park Service, Midwest Archaeological Center, Lincoln, Nebraska (1994), 7.

16 Chavez, 1.

17 Tinkham, 13.

18 U.S. Lighthouse Board, "To Purify Water at Light-House Stations," *Amendment of Light-House Regulations* (n.d.), 55.

19 Rachel Franklin Weekley, *Historical Data Section: Cultural Landscape Report, Au Sable Light Station, Pictured Rocks National Lakeshore, Michigan*. Prepared for the U.S. Department of the Interior, National Park Service, Midwest Regional Office (Omaha, NE: August 1994), 63.

20 Ibid., 64.

21 Mark F. Pfaller Associates, Inc., 3.

22 Jones, 23.

23 Ibid., 23.

24 Douglas S. Walter, *Historic Structures Report, Architectural Data Section, Au Sable Light Station, Pictured Rocks National Lakeshore, Michigan*. Prepared for the U.S. Department of the Interior, National Park Service, Denver Service Center, Denver, Colorado (September 1978), 17.

25 Tinkham, 9.

26 David A. Clary. *Au Sable Light Station, Pictured Rocks National Lakeshore: The Life of the Keepers as Reflected in Their [sic] Official Journals*. Prepared for the U.S. Department of the Interior, National Park Service, Midwest Regional Office (Omaha, NE: 1975), 4.

27 Mark F. Pfaller Associates, Inc., 3.

28 "Au Sable Light Station, Michigan, June 22, 1935," This is an excerpt included in a letter from the Commander, Ninth Coast Guard District, Cleveland, Ohio to George B. Robinson, Division of Planning and Interpretive Services, National Park Service, 23 June 1969.

29 Rachel Franklin Weekley, "Notes Taken by Rachel Franklin Weekley [from] Record Group 26: Records of the U.S. Coast Guard, Records of the Lighthouse Service. Lighthouse Station Logs, 1897-1941. Ashtabula, 1934-1940 Thru Baker's Island, 1931-1939," July 1994, National Archives,

20.

30 "Au Sable Light Station, Michigan, June 22, 1935," This is an excerpt included in a letter from the Commander, Ninth Coast Guard District, Cleveland, Ohio to George B. Robinson, Division of Planning and Interpretive Services, National Park Service, 23 June 1969.

31 Mark P. Pfaller Associates, Inc., 7.

32 "Au Sable Light Station, Michigan, June 22, 1935," This is an excerpt included in a letter from the Commander, Ninth Coast Guard District, Cleveland, Ohio to George B. Robinson, Division of Planning and Interpretive Services, National Park Service, 23 June 1969.

33 Jones, 10.

34 Clary, 6.

35 Rachel Franklin Weekley, "Notes Taken by Rachel Franklin Weekley [from] Record Group 26: Records of the U.S. Coast Guard, Records of the Lighthouse Service. Lighthouse Station Logs, 1897-1941. Ashtabula, 1934-1940 Thru Baker's Island, 1931-1939," July 1994, National Archives, 23.

36 Clary, 3.

37 Ibid., 4.

38 Jones, 9.

39 Rachel Franklin Weekley, "Notes Taken by Rachel Franklin Weekley [from] Record Group 26: Records of the U.S. Coast Guard, Records of the Lighthouse Service. Lighthouse Station Logs, 1897-1941. Ashtabula, 1934-1940 Thru Baker's Island, 1931-1939," July 1994, National Archives, 26.

40 Ibid., 16.

41 Jones, 19.

42 Rachel Franklin Weekley, "Notes Taken by Rachel Franklin Weekley [from] Record Group 26: Records of the U.S. Coast Guard, Records of the Lighthouse Service. Lighthouse Station Logs, 1897-1941. Ashtabula, 1934-1940 Thru Baker's Island, 1931-1939," July 1994, National Archives, 1.

43 Walter, 30.

44 Rachel Franklin Weekley, "Notes Taken by Rachel Franklin Weekley [from] Record Group 26: Records of the U.S. Coast Guard, Records of the Lighthouse Service. Lighthouse Station Logs, 1897-1941. Ashtabula, 1934-1940 Thru Baker's Island, 1931-1939," July 1994, National Archives, 18.

45 Ibid., 16.

46 "Au Sable Light Station, Michigan June 22, 1935," This is an excerpt included in a letter from the Commander, Ninth Coast Guard District, Cleveland, Ohio to George B. Robinson, Division of Planning and Interpretive Services, National Park Service, 23 June 1969.

47 Rachel Franklin Weekley, "Notes Taken by Rachel Franklin Weekley [from] Record Group 26: Records of the U.S. Coast Guard, Records of the Lighthouse Service. Lighthouse Station Logs, 1897-1941. Ashtabula, 1934-1940 Thru Baker's Island, 1931-1939," July 1994, National Archives, 1.

48 Tinkham, 12.

49 Ibid., 15.

50 Rachel Franklin Weekley, "Notes Taken by Rachel Franklin Weekley [from] Record Group 26: Records of the U.S. Coast Guard, Records of the Lighthouse Service. Lighthouse Station Logs, 1897-1941. Ashtabula, 1934-1940 Thru Baker's Island, 1931-1939," July 1994, National Archives, 20.

51 Ibid., 16.

52 Ibid., 16.

53 Rachel Franklin Weekley, *Historical Data Section: Cultural Landscape Report, Au Sable Light Station, Pictured Rocks National Lakeshore, Michigan*. Prepared for the U.S. Department of the Interior, National Park Service, Midwest Regional Office (Omaha, NE: August 1994), 61.

54 Ibid., 62.

Part E:
Building and Site Chronology

Part E: Building and Site Chronology

History of Alterations and Additions

Physical investigation has revealed that a significant portion of the extant materials of the Double Keepers' Duplex Residence (HS-11), the attached Passageway, and the Tower (HS-10), date to the original construction of 1873 -1874. At the same time, however, several of the elements and finishes are not original. They are reproductions constructed during the period of 1988 through 1990 as part of the National Park Service's efforts to restore the interior of these structures back to their 1909 - 1910 appearance. The year, 1909, is pivotal in the history of the lighthouse complex in that it marked the most significant amount of physical change at the station during its entire history, and included the construction of the two-story addition to the east end of the Double Keepers' Duplex Residence (HS-11), and the construction of an additional Keeper's Dwelling (HS-09).

The Au Sable Light Station continuously evolved over the course of its lifetime. Much of the manipulation of the site, such as the ongoing cutting away and/or burning of trees, was a direct result of the Lighthouse Service's requirement that the keeper ensure the light's visibility at all times. Further, the keepers were required to follow strict regulations and guidelines regarding the maintenance and finishes of the individual structures. Otherwise, there were few regulations placed on the keepers with respect to the actual land. This allowed the keepers and their families the opportunity to alter the site according to their personal needs and desires for self expression. However, as evidenced in historic documentation and photographs, the site did not lend itself well to gardening and other manipulation. There are though, some elements which were introduced by individual keepers, such as garden layouts, fruit tree plantings, and the construction of a hennery.

Physical change at the complex was usually directly correlated with necessity in terms of improving the efficiency of the light station. As a result, alterations were kept to a minimum. When they did occur, they were generally the result of the development of new technology which directly effected the station's efficiency. What follows is the history of the Au Sable Light Station, which is divided into distinct episodes of time based upon physical changes at the station.

Analysis of Episodes

Episode I: 1873 - 1895

Significant features and/or events: Original keeper's dwelling (HS-11), attached passageway, and tower (HS-10) constructed; boathouse (HS-17), brick privy (F3), and wood frame storage building constructed.

The first building erected on the site was temporary shelter for the work crews constructing the lighthouse. As the district engineer wrote to the Lighthouse Board on August 7, 1873, "Quarters for the men and the wharf and approaches have been constructed and the excavation of foundation begun. Everything is ready for vigorous prosecution of this work."[1] Construction of the Tower, the attached Passageway, and the keeper's dwelling was completed during the early 1874 season. The lamp was first lit, and the station officially put into operation, on August 19, 1874.

In addition to the main structures, a few outbuildings were constructed in conjunction with or shortly after the original keeper's dwelling (HS-11), including a brick privy and a wood frame storage building, both of which were located east of the original keeper's dwelling (HS-11). A boathouse was also constructed, and was located near the edge of the bluff along the shore, close to the wharf. **Figure 63** is a view of the entire Au Sable Light Station as it appeared from the water in 1891.

Aside from minor interior alterations that were undertaken as part of the routine maintenance and upgrading of the station, the original massing of the 'lighthouse,' that is, the original keeper's dwelling (HS-11), attached passageway, and the tower (HS-10), remained unaltered until 1909, at which time major construction was undertaken. Thus, there was a 36 year period in which the main structures experienced relatively few physical alterations. An indication of the efficiency of operations and the utilitarian attitude of the Lighthouse Service is reflected in a August 17, 1903 request for miscellaneous repairs at Au Sable from the district inspector to the chairman of the Lighthouse Board, who says that the station, "has had only the most necessary repairs since its construction."[2]

There are no known extant historic photographs of the interior of the original Keeper's Dwelling (HS-11) or of the Tower (HS-10). All information regarding the interior has been gathered from historic drawings, such

Figure 63

View looking south from Lake Superior toward the Au Sable Light Station, 1891.

Figure 64

Tracing of a U.S. Lighthouse Service drawing depicting the original keeper's dwelling and attached passageway constructed at the Au Sable Light Station and the Outer Island Light Station, both on Lake Superior. Undated.

as **Figure 64**, and from written documentation including journal entries of various keepers who worked at the station and correspondence written by district engineers and inspectors to the Lighthouse Board. However, most of the documentation is brief, and typically only contains vague descriptions of the everyday activities of the keepers, such as cleaning and painting.

There is no documentation regarding the assistant keepers who were stationed at Au Sable from almost the beginning of its operation (there are requests for assistant keepers as early as 1875) until proper accommodations were constructed for them in 1909. Prior to this, there was only the original keeper's dwelling (HS-11), which was laid out as a single-family residence. Furthermore, there were apparently no significant outbuildings which the assistant keepers could have occupied as a temporary residence during the season, as was the case during the early years at other light stations on the Great Lakes. The precise living situation through both the first and second episodes of time in the light station's history is unknown, however it is assumed that the assistant occupied a bedroom in the original keeper's dwelling. Also, the *Historic Furnishings Study* written Mark P. Pfaller Associates, Inc., states that the three men (the keeper and his two assistants) lived together in the single quarters for a period of time before the construction episodes in 1909 - 1910."[3] This assumes that the families of the keepers did not reside at the station, and that it was more of a dormitory style of living.

Episode II: 1896 - 1908

Significant features and/or events: Brick oil house (HS-13), fog signal building (HS-16), and second wood frame storage building are all constructed.

The U.S. Lighthouse Service continuously sent work crews to the light stations throughout the Great Lakes to construct new structures and to make repairs or alterations to existing ones. A crew most likely visited the Au Sable Light Station during the 1903 season to replace the roof of the Keeper's Dwelling (HS-11) with stamped sheet metal shingles. The choice of stamped sheet metal shingles was significant, because not only were they popular for residential construction during the early 20th century, but they were also considerably more durable than the former wood shingles.

The Fog Signal Building (HS-16) was constructed in 1897. As was common with many of the structures at the light stations, it was built using a standard design plan developed by the district engineer.

In addition to the Fog Signal Building (HS-16), several other secondary structures were constructed at the Au Sable Light Station in 1897, all of which served to improve the efficiency of the station. A boatway and crib were constructed at the end of the dock to assist in the landing of boats and supplies. A pump house was also constructed at the end of the dock; the pump drew lake water and then fed it via an elaborate pipe system along the dock and up to the steam boilers in the Fog Signal Building (HS-16). A telegraph/telephone line was also laid from the Coast Guard station in Grand Marais, across the Grand Sable sand dunes, to the Au Sable Light Station.

Work continued in and around the Fog Signal Building (HS-16) and dock area to improve the efficiency and ease of landing supplies, etc. The following year, 1898, a tramway from the dock to the Fog Signal Building was built, and a hoisting engine installed near its end in the Fog Signal Building to operate the tram. In 1901, two "roller boatways with [an] iron winch [were] constructed" between the boathouse and the lake to assist in getting the station's boat in and out of the water.[4] Also in 1901, repairs were made to the wood tramway, and a turntable was constructed to allow directional changes of the tram, thereby making it easier for the tram to move between the dock and the Fog Signal Building (HS-16). Further, due to the continuous erosion caused by the waves of Lake Superior, a stone and concrete 'seawall' was built in 1906. The wall was approximately 4' - 6" high, began at the dock, and extended west approximately 68'.

In 1904, a spherical brick cistern was constructed underground east of the Fog Signal Building (HS-16). This cistern was constructed to store and cool excess overflow water from the operation of the steam boilers in the Fog Signal Building.

Other physical changes took place during this episode near the main structures of the complex. In 1901, wood boardwalks (sidewalks) were constructed connecting the dock area, the Fog Signal Building (H-16), and the main structures and outbuildings of the complex. These outbuildings included a small wood frame structure, which was constructed east of the original keeper's

dwelling (HS-11) circa 1903. Historic photographs reveal that this wood frame storage shed had white clapboard siding and resembled the first wood frame structure constructed at the complex which was located south of the original keeper's dwelling (HS-11). Both structures were presumably used as woodsheds and/or for other types of outdoor storage, however, it is not known whether the first shed was torn down following the construction of the second or if both remained in use for several years together.

Episode III: 1909 - 1958

Significant features and /or events: Addition to HS-11 constructed, becomes the Double Keepers' Duplex Residence; new privy (HS-15) constructed for HS-11; construction of new Keeper's Dwelling (HS-09) and privy (HS-14); metal oil house (HS-12) constructed; second woodshed constructed south of the Keeper's Dwelling (IIS-09); installation of air diaphone system and alterations to the fog signal building. In 1939 the station is placed under Coast Guard control, electricity and heating are installed in the dwellings, tower, and fog signal building, and there are several other technological upgrades.

The largest of the construction alterations that took place in 1909 was the demolition of the one-story wing at the east end of the original keeper's dwelling (HS-11), and the construction of a two-story addition in its place. This change allowed for the transition of the structure from a single-family dwelling into a duplex, which could house two assistant keepers and their families. In conjunction with this construction, an entirely new keeper's dwelling (HS-09) was constructed west of the original one, the purpose of which was to house the head keeper and his family.

Several other changes, much smaller in scale, also took place at the Double Keepers' Duplex Residence (HS-11). A brick cistern was constructed in the northeast corner of the basement, and the building's drainage system was altered to divert water into this cistern to store for domestic use. All of the existing window openings were widened, and the segmented brick arches, which supported the openings at the exterior brick wythe, were replaced with concrete lintels.

In addition to the construction alterations at the Double Keepers' Duplex Residence (HS-11), and the construction of the new Keeper's Dwelling (HS-09), several other alterations and new additions were implemented at the station in 1909. All of the board sidewalks at the station, with the exception of the boardwalk between the boathouse (HS-17) and the Fog Signal Building (HS-17), were replaced with concrete sidewalks.

One significant change to the station during this episode, which was not a physical alteration of the complex, was the station's name change from Big Sable to Au Sable in 1910. The keeper noted in a journal entry in 1910 that he had "Received [a] letter from [the] Inspector to day, changing [the] name of [the] Station to Au Sable."[5] By the sounds of this entry, the change appeared to have little, if any, impact on the daily activities of the keepers.

Although a telegraph line had been laid to the station (across the Grand Sable Dunes from Grand Marais) as early as 1897, historic documentation referring to a telephone line reaching the station does not appear until 1919. Rachel Weekley notes in her chronology of the station that in 1919 the "U.S. Coast Guard telephone lineman surveyed route for [the] installation of telephone line."[6] In 1935, a telephone line was installed by the Coast Guard, and apparently a telephone was installed in the Keeper's Dwelling (HS-09). A second telephone was installed in the Double Keepers' Duplex Residence (IIS-11) the following year.

Later in this episode of Au Sable's history, several changes were implemented at the Fog Signal Building (HS-16). In 1928, the steam boilers and whistles were removed and a new air diaphone system was installed. The following year, new concrete sidewalks were laid between the dwellings and the outbuildings, including the Fog Signal Building (HS-16). Also in 1929, new oil tanks were installed in the Fog Signal Building (HS-16). Furthermore, throughout the late 1920s and the 1930s, repairs were made to the tramway, boat dock, and the seawall. Also, additions and upgrades to the concrete sidewalk system were made in both 1931 and 1936.

Other changes during this episode which affected the Double Keepers' Duplex Residence (HS-11) included the addition of two windows at the west end of the original structure, one at the north elevation and one at the south. In 1935, the full width porch at the east elevation was entirely replaced with a porch consisting of a concrete deck and stairs. This porch is shown in **Figure 65** as it appeared just prior to its demolition in 1990.

Figure 65

Detail view of the southeast corner of the concrete porch which was constructed in 1935 to replace the original wood porch at the east elevation of the Double Keepers' Duplex Residence (HS-11), 1995.

Figure 66 shows the lighthouse complex as it would have been seen by boats, such as Lighthouse Service tenders, approaching the site on Lake Superior. However, in 1939, the U.S. Lighthouse Service was absorbed into the United States Coast Guard and lighthouse tenders were no longer used. This change appears to have had minimal direct physical impact on the Au Sable Light Station. No documentation was found describing either changes in the status of the employees, or in any immediate changes to the physical appearance of the station. **Figure 67** is a photograph of the Au Sable Light Station, circa the early 1940s, as it appeared during the early years under the authority of the United States Coast Guard.

At the interior of the Double Keeper's Duplex Residence (HS-11), however, several changes were implemented by the Coast Guard as the direct result of the availability of improved technology. Interior partition walls were constructed to create a bathroom at both floors of the structure in 1939. Both bathrooms were located at the southwest corner of the building. Also, the bottom two steps of the main stair to the second floor, at the west end of the building, were modified. These stairs were changed to accommodate a new door opening, at the north adjoining wall, which provided access into the northwest bedroom (Room 103). Prior to the construction of this door opening, there had not been a direct access into this bedroom from the hall; it could only be accessed through the Living Room

Figure 66

View looking southwest toward the Au Sable Light Station from the water, June 1938.

Figure 67

View looking northwest at the main area of the lighthouse complex, circa 1940s. Note the evidence of technological upgrades at the station, including the telephone line, the cars, and the concrete porch at the Double Keepers' Duplex Residence (HS-11).

(Room 102). As part of the 1989 - 1990 restoration work performed by the National Park Service, this non-original opening was infilled and finished to match the adjacent wall surfaces, and the stairs were reconstructed to their original appearance. Both the first floor and the second floor kitchens were upgraded in 1949 and central heating was installed in 1950.

Many of the same changes took place at the Keeper's Dwelling (HS-09) also. The kitchen was upgraded in 1949, central heating was installed in 1950, and in 1951, a new 220' deep well was drilled west of the dwelling. Presumably this well provided drinking water to both of the dwellings.

Electricity was also introduced to the complex following its acquisition by the Coast Guard. In 1943, the Keeper's Dwelling (HS-09), the Double Keepers' Duplex Residence (HS-11), and the Tower (HS-10) were all wired for electricity. The duties of the keepers were greatly lessened with the introduction of electricity. No longer did the light's wick need to be trimmed, the kerosene filled, or many of the other time consuming jobs assigned to the keepers be performed. Several other changes were implemented as a result of the introduction of electricity. Diesel generators, for example, were installed in the Fog Signal Building (HS-16) and generated the electricity for the entire complex.

Related site changes that took place in 1951 - 1952 included: the installation of a metal flag pole, erected in a concrete footing, which was put up near the Tower (HS-10) in 1952 replacing the earlier flagpole which was in jeopardy due to its location at the bluff's edge, and, extensive repairs to the concrete seawall, including an extension.

In 1954, the wood frame garage (HS-9a) at the west end of the Au Sable Light Station was constructed. The construction drawing for this structure states, 'Salvaged material.' There is some speculation that the wood frame shed, south of the Keeper's Dwelling (HS-09)

was also torn down in 1954. This being the case, the garage may have been constructed with the 'salvaged material' from that structure.

In 1958, the Coast Guard officially unmanned the Au Sable Light Station by automating the light and discontinuing the operation of the fog signal, leaving the station in its existing configuration. A Coast Guard letter dated, 23 June 1969 states that, "The station was manned until 1958 when automatic equipment was installed. At that time the light consisted of a flashing white light of 6750 candlepower with a third order lens."[7]

Episode IV: 1959 - 1967

Significant features and /or events: Virtual abandonment of the station by the Coast Guard, regrowth of the natural site and deterioration of the architectural fabric.

This episode in the history of the Au Sable Light Station saw the slow deterioration of many aspects of the station. Although the light itself remained in operation as an automatic aid to navigation, all of the personnel at the station were removed, leaving the complex completely abandoned. The Coast Guard then made only infrequent checks of the light because "when the light was automated [in 1958], an automatic bulb changer was installed and a bell buoy was placed offshore near the shoal areas," making frequent, routine maintenance unnecessary.[8] Later, when navigational aides improved, and became more commonly used such as radar, the intensity of the light required was lessened. Eventually, the Fresnel lens was removed and replaced with a small acrylic lens, which was powered by a battery bank that was located in the northeast corner of the attached passageway.

The last significant change that the Coast Guard initiated at the complex was the construction of an 8" thick, concrete block wall within the attached passageway in 1960, as indicated in Figure 68. This wall blocked the access between the dwelling and the tower and was installed to prevent any tampering with the light and to ensure visitor safety in anticipation of the complex being opened to the public. A white line representing the location of the concrete block on the exterior of the passageway indicated the "lot line" which encompassed the minimum amount of land required around the aid to navigation (tower), which was approximately a 30' x 30' plot. In 1961, the Coast Guard declared the rest of the land occupied by the lighthouse complex excess property.

When the Coast Guard did visit the complex for infrequent maintenance checks, they were likely performed within a few hours by Coast Guard personnel from the nearby Grand Marais station. As a result, the upkeep of the site was not a Coast Guard priority, hence, the complex was pretty much left to return to its natural, pre-lighthouse condition. The trees and brush were no longer regularly cleared to keep a line of sight open for passing ships, and the tramway and its related equipment were dismantled and removed.

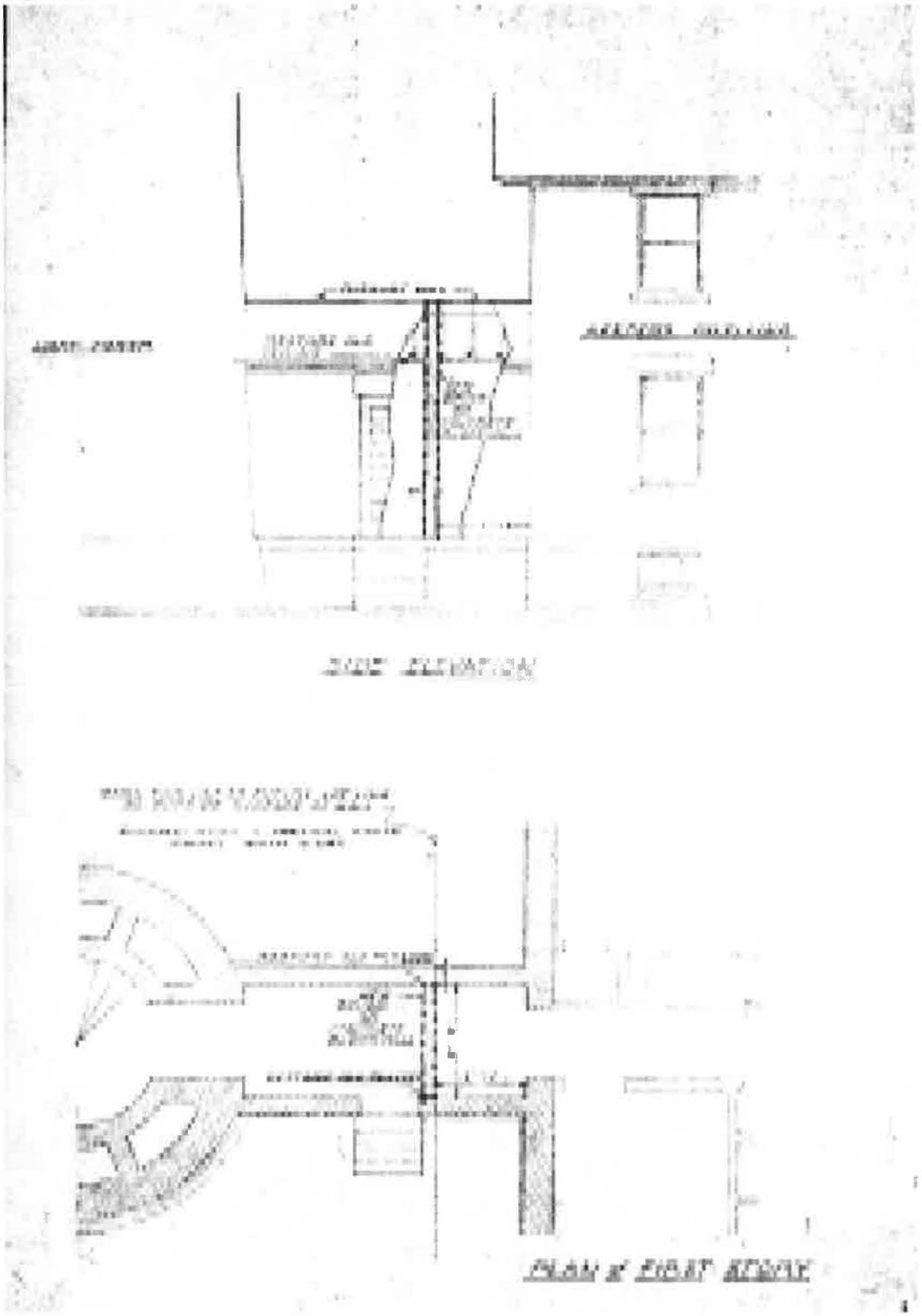
Episode V: 1968 - Present

Significant features and /or events: National Park Service stabilization and limited restoration.

Upon acquisition of the Au Sable Light Station from the U.S. Coast Guard in 1968, the National Park Service incorporated it into the Pictured Rocks National Lakeshore, which had previously been established in 1966. On January 12, 1968, "All USCG property with the exception of the lighthouse [tower] itself is transferred to the National Park Service."[9] **Figure 69** is a drawing originally dated 1908, but with several additions over the years. The last addition to the drawing was the perimeter demarcation signifying the 30' x 30' piece of property surrounding the light tower (HS-10) that was to remain in Coast Guard ownership. This division of property was also indicated on the actual property by a white line painted on both the north and the south elevation of the passageway, as shown in **Figure 70**. The National Park Service was quick to realize the cultural and historic importance of the light station, and soon nominated it for placement on the National Register of Historic Places. It was officially placed on the register in 1978. In 1988, Historic American Buildings Survey (HABS) drawings of the complex, including both of the dwellings, the tower, the fog signal building, and the boathouse were completed.

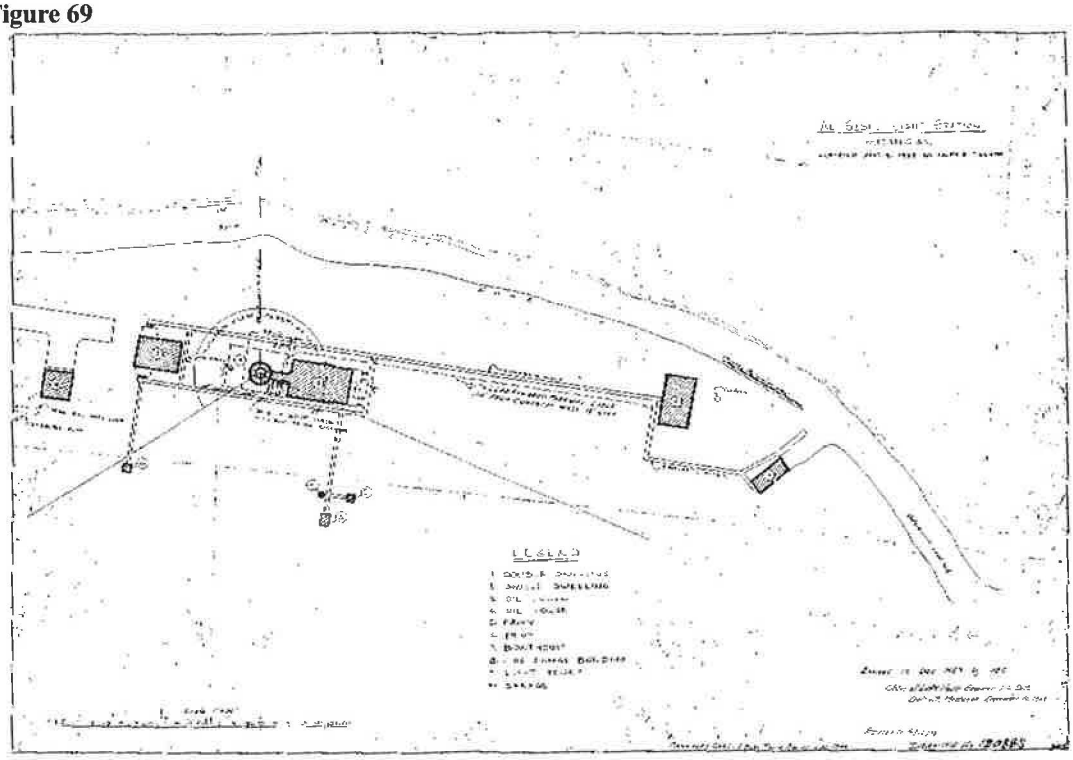
During the 1970s, extensive stabilization efforts were undertaken by the National Park Service with the intention of the future preservation and restoration of the entire Au Sable Light Station. Following preliminary historic research, an extensive amount of demolition of non-period elements, restoration of historic elements, and the reconstruction of missing historic elements were undertaken to begin to restore the interior of both the

Figure 68



Construction drawing for the 1960 concrete block wall installed within the passageway by the Coast Guard to secure the tower.

Figure 69



Survey drawing of the Au Sable Light Station drawn in conjunction with an official U.S. Lighthouse Service description of the station in 1909 with significant revisions to the drawing in 1935, 1944, and 1959.

Figure 70

View of the south elevation of the passageway connecting the Tower (HS-10) with the Double Keepers' Duplex Residence (HS-11), 1995.

Figure 71

View looking west toward the Double Keepers' Duplex Residence (HS-11) and the Tower (HS-10), 1995.

Double Keepers' Duplex Residence (HS-11) and the Tower (HS-10) to their appearance of 1909-1910. The Lakeshore's files contain maintenance records of all of the work carried out during this period. Stabilization efforts included the construction of a timber retaining wall at the bluff's edge to protect the Fog Signal Building (HS-16) in 1974, and the replacement of roofing at both the Fog Signal Building (HS-16) and the Boathouse (IIS-17) in 1976.

The Coast Guard replaced the Fresnel lens with a 300 mm acrylic lens in 1972. The new acrylic lens was attached to the top of the exterior balustrade at the tower's parapet. It has remained in that location through 1995, powered by solar panels, which are attached to the south facing portion of the balustrade. Following the relocation of the light to the exterior of the lantern, the lantern glass panels were replaced with plywood to deter vandalism and deterioration of the tower's interior. In 1983, the National Park Service removed the plywood and installed Lexan panels in their place, as seen in **Figure 71.**

When the glass panels were removed, the Fresnel lens was also removed from the lantern. Following its removal, the location of the Fresnel lens was unknown for several years. Investigation by National Park Service personnel found that the lens was stored in a Coast Guard warehouse in Cleveland, Ohio. The National Park Service brought the lens to Grand Marais where, for several years, it was on display at the Maritime Museum. However, as part of its ongoing restoration efforts, the National Park Service intended to return the Fresnel lens to its original location on the pedestal in the lantern room during the 1995 season.

The National Park Service began more aggressive stabilization and restoration treatments in the late 1980s. As stated in National Park Service records, significant work was undertaken at the Double Keepers' Duplex Residence (HS-11) during the years 1988 through 1990. Work funded through the cyclical maintenance program of the National Park Service, and performed in the fiscal year 1988, referred to as Phase One work included: initial historical investigation; paint analysis; the fabrication and installation of missing wood moldings, trim, and flooring; removal of the post-1909 fabric; restoration of the walnut balustrade and staircase members; and, repair of the deteriorated plaster walls and ceiling.[10] Furthermore, the removal of the post-1909 fabric included: all electrical wiring and electrical hardware; cast iron waste lines; galvanized and copper water lines; the coal bin; the heating duct piping; and portions of the forced air furnace.[11]

Several fuel tanks were removed from the site through the combined efforts of the Coast Guard and the National Park Service in 1988. This removal included, but was not limited to, the underground tank south of the Fog Signal Building (IIS-09a) and the underground tank south of the Garage (HS-09a). The excavation and removal of the fuel tanks was monitored by Bruce A. Jones, an archeologist for the National Park Service.

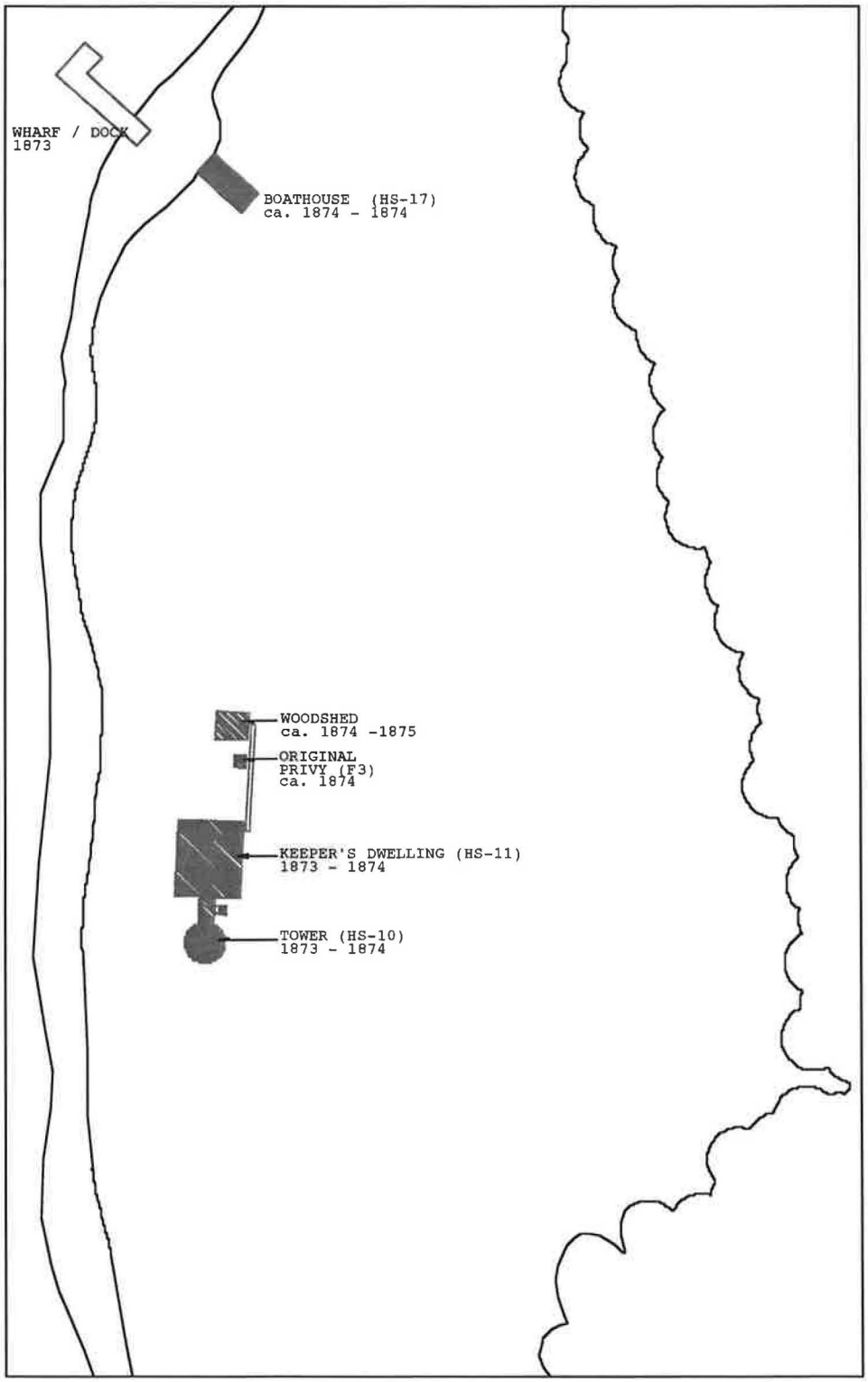
Phase two restoration work at the Double Keepers' Duplex Residence (HS-11) took place during the 1989 fiscal year. This work included: the repair of the interior plaster surfaces; the restoration of the front porch to its 1909 - 1910 appearance; paint analysis; the refinishing of the wood staircases; the stripping of paint from all moldings, windows, doors, and floors; the painting of all interior and exterior surfaces; the restoration of the windows; the fabrication of historic moldings; and the removal of asbestos insulation in the basement.[12]

Conclusion

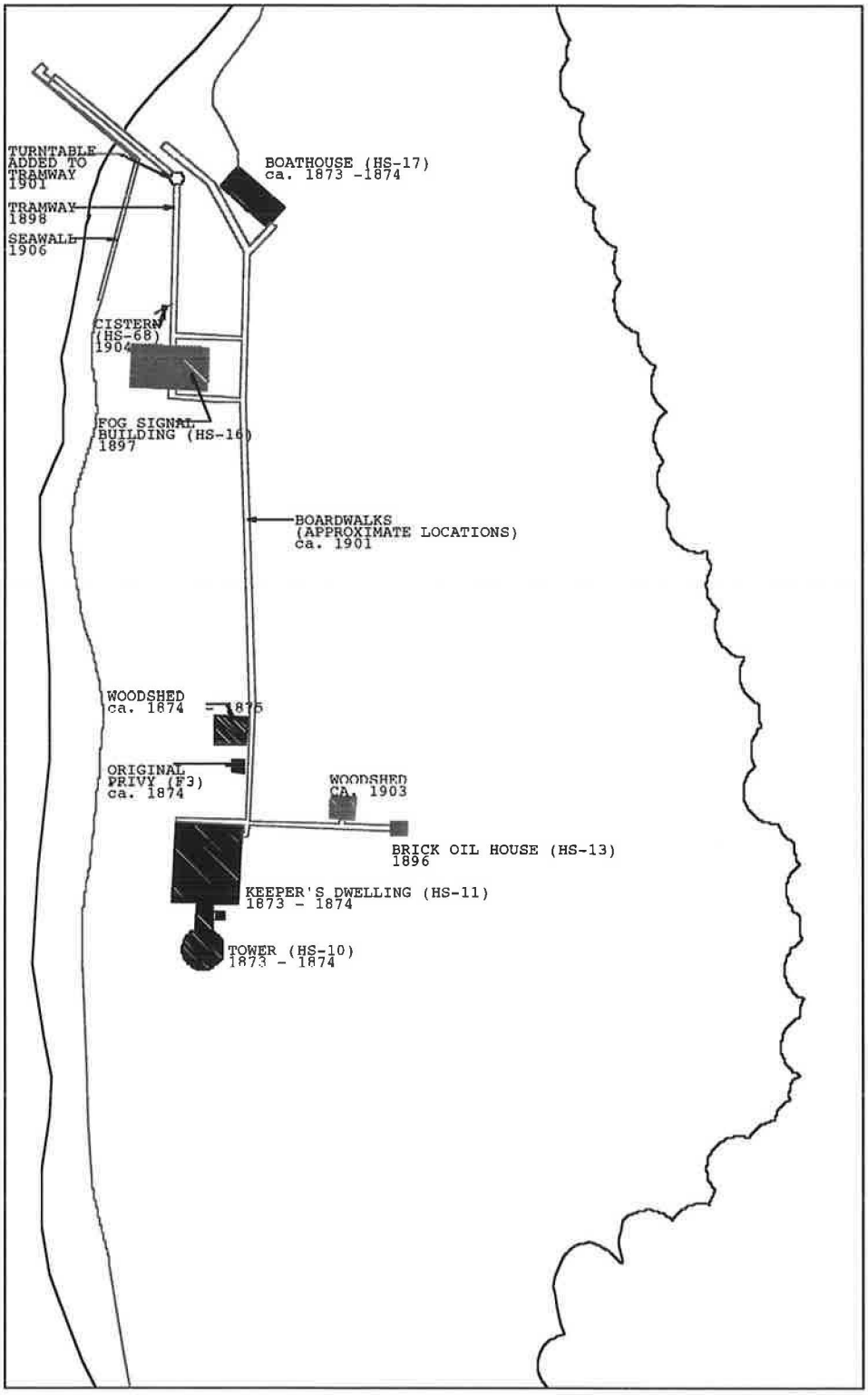
As of 1995, the Au Sable Light Station has undergone five primary episodic changes throughout its 121 year life span. However, it is important to remember that the utilitarian function of the station kept actual physical changes to a minimum. Alterations were generally undertaken only when new technology became available, such as the upgrading of the Fog Signal Building (HS-16), or when additional people were needed to operate the facility, creating a need for such things as additional housing, and related outbuildings.

The lighthouse complex was built to protect the lives of the people, and the goods traveling on the often turbulent Lake Superior. The most efficient means of achieving the work at the complex was always sought. Episode II, spanning 1909 - 1939, is the time period in which the most extensive amount of alteration and additions to the site were undertaken. The other episodes represent significant periods of change, but more in a sense of technological upgrades and other subsidiary site additions, not significant construction alterations.

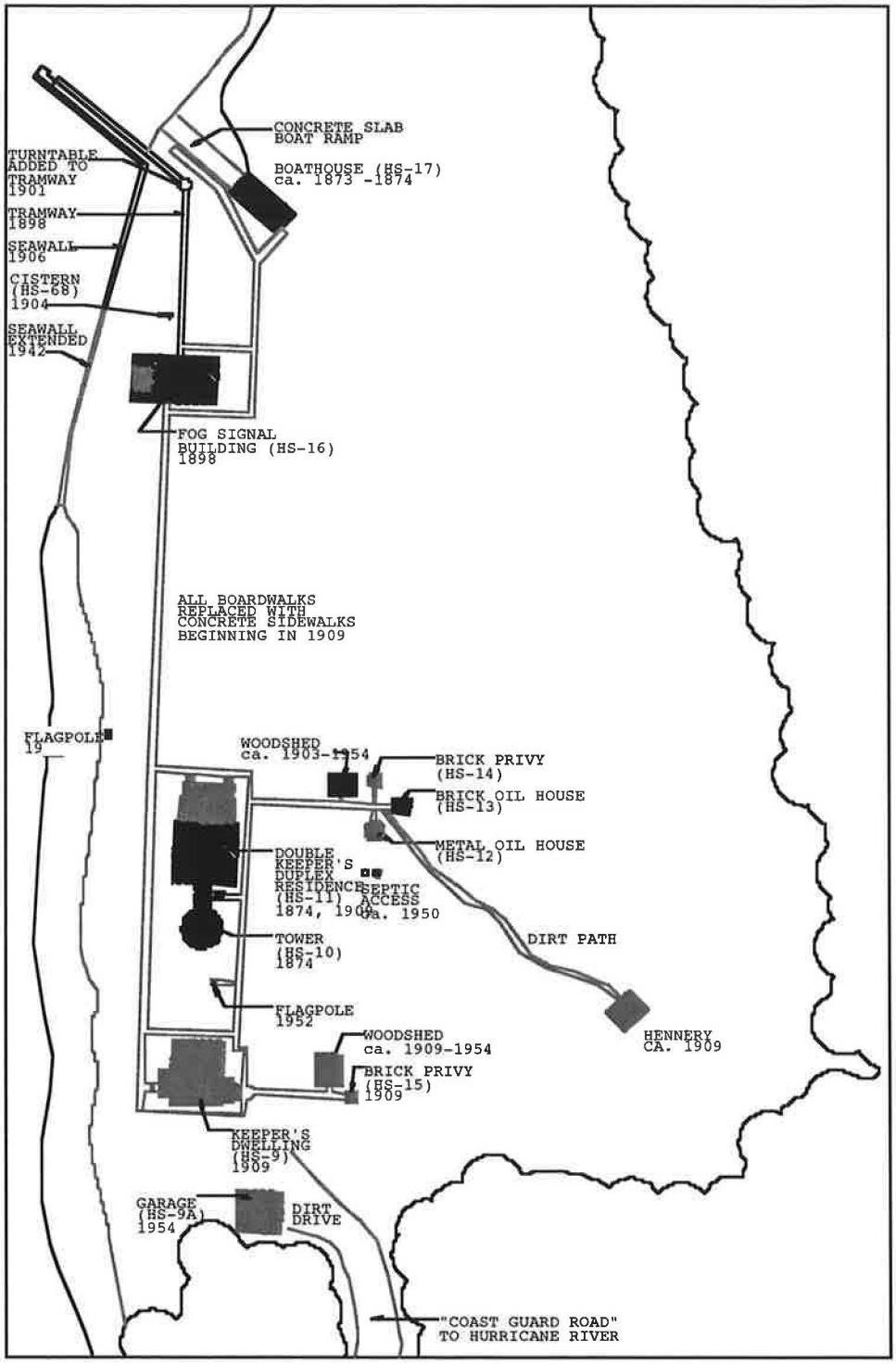
Episode I: 1873 - 1895



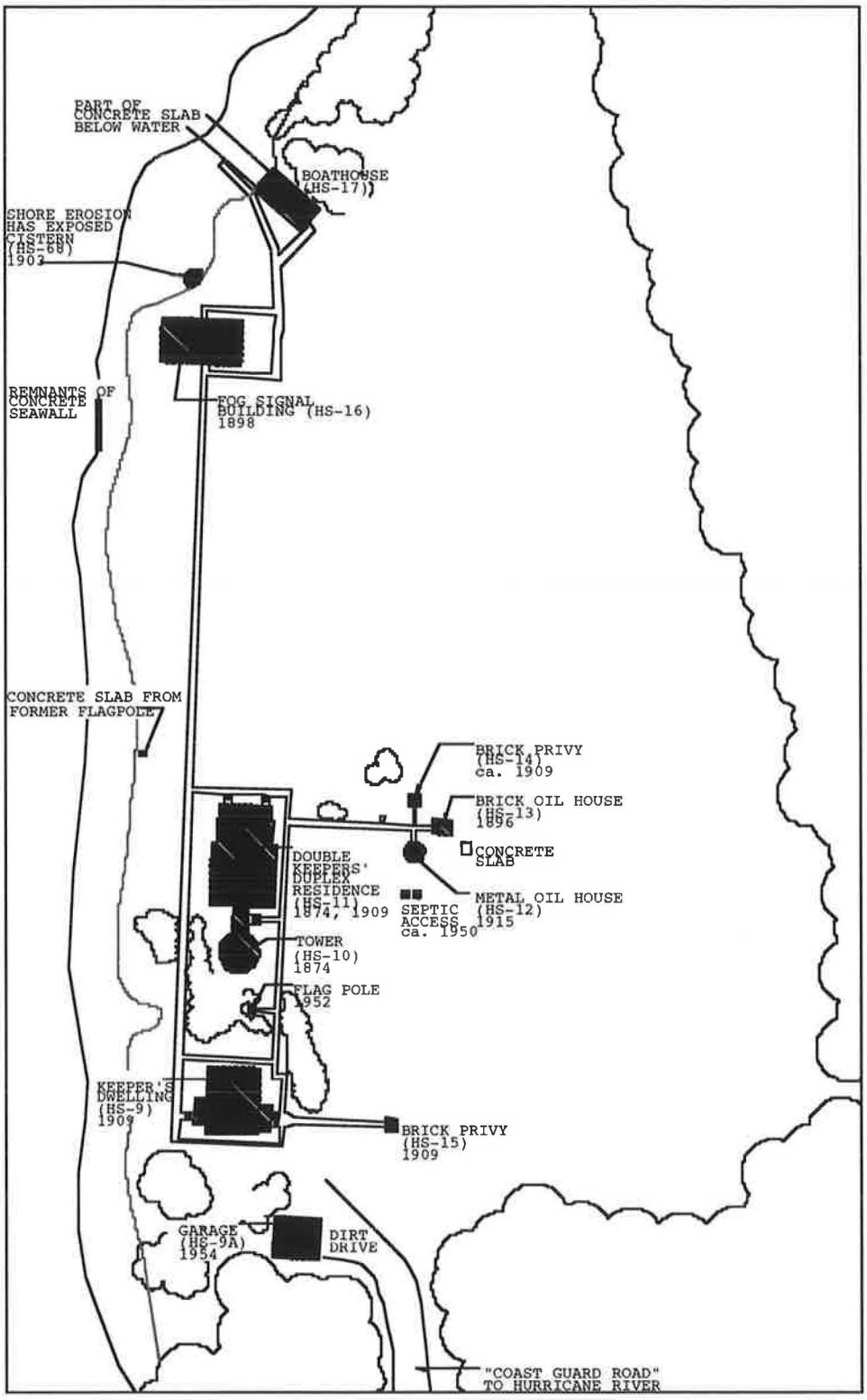
Episode II: 1896 - 1908



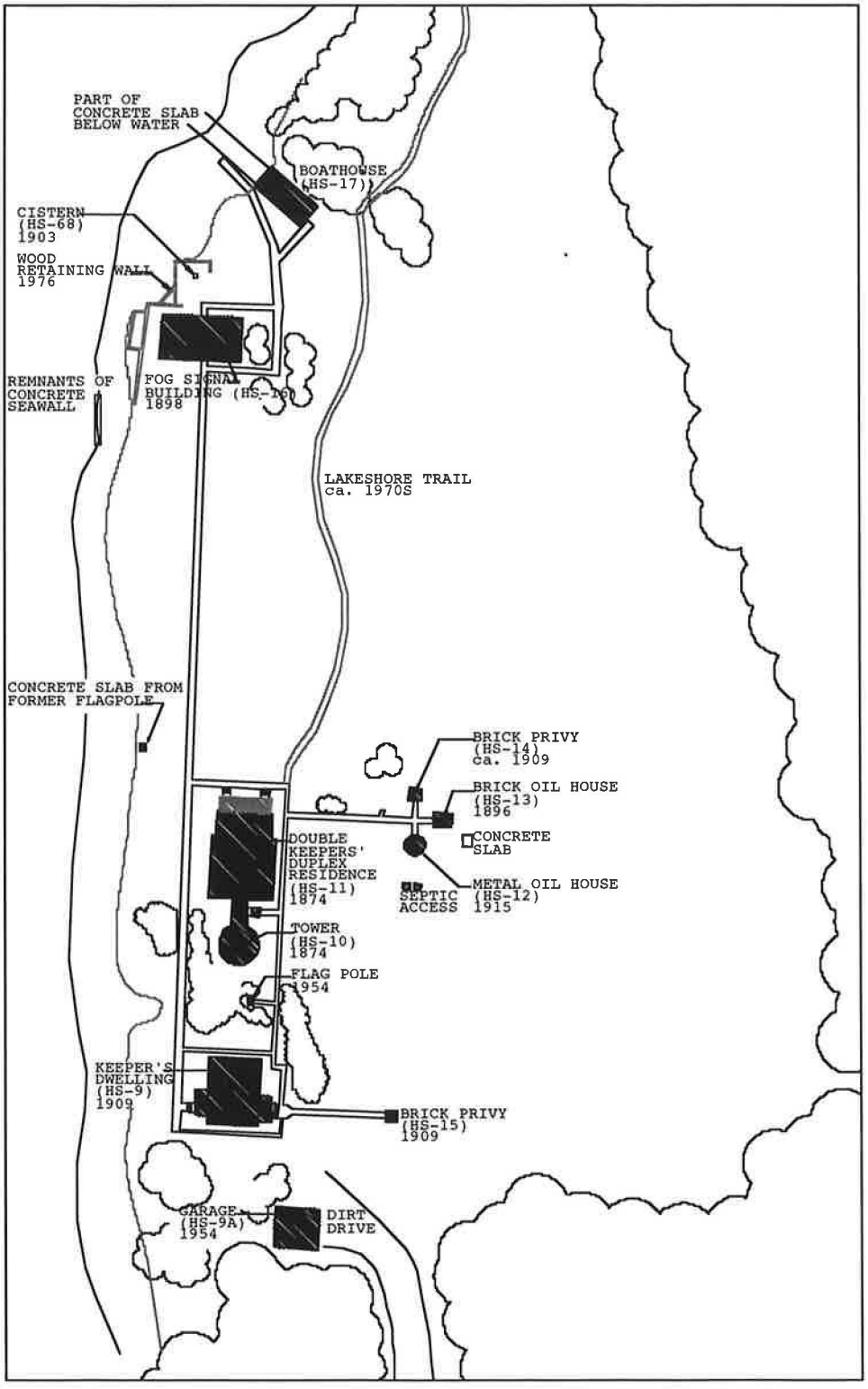
Episode III: 1909 - 1958



Episode IV: 1959 - 1967



Episode V: 1968 - Present



1 Enviroscience, Inc. *Historic Structure Report, 95% Submittal, Au Sable Lighthouse Complex, Pictured Rocks National Lakeshore, Michigan*. Prepared for the U.S. Department of the Interior, National Park Service, Office of Planning and Resource Preservation, Division of Cultural Resources Management, Omaha, Nebraska (Eden Prairie, MN: 1991), III-2.

2 Mark F. Pfaller Associates, Inc. *Historic Furnishings Study, Au Sable Lighthouse, Pictured Rocks National Lakeshore* (Milwaukee, WI: 1981), 1.

3 Mark Chavez, *Historic Structures Report, Chapter VIII, Au Sable Lighthouse Complex, Pictured Rocks National Lakeshore, Michigan*. Prepared for the U.S. Department of the Interior, National Park Service, Midwest Regional Office (1994), 2.

4 Douglas S. Walter, *Historic Structures Report, Architectural Data Section, Au Sable Light Station, Pictured Rocks National Lakeshore, Michigan*. Prepared for the U.S. Department of the Interior, National Park Service, Denver Service Center, Denver, Colorado (September 1978), 4.

5 David A. Clary, *Au Sable Light Station, Pictured Rocks National Lakeshore: The Life of the Keepers as Reflected in Thier [sic] Offictal Journals*. Prepared for the U.S. Department of the Interior, National Park Service, Midwest Regional Office (Omaha, NE: 1975), 5.

6 Rachel Franklin Weekley, *Au Sable Light Station Summary Site Chronology* (n.d.), 2.

7 Commander, Ninth Coast Guard District, Cleveland, Ohio to George B. Robinson, Division of Planning and Interpretive Services, National Park Service, Harpers Ferry, WV, 23 June 1969, PIRO files.

8 Dennis L. Noble and T. Michael O'Brien, *Sentinels of the Rocks: From "Graveyard Coast" to National Lakeshore* (Marquette, MI: Northern Michigan University Press, 1979), 17.

9 Walter, 5.

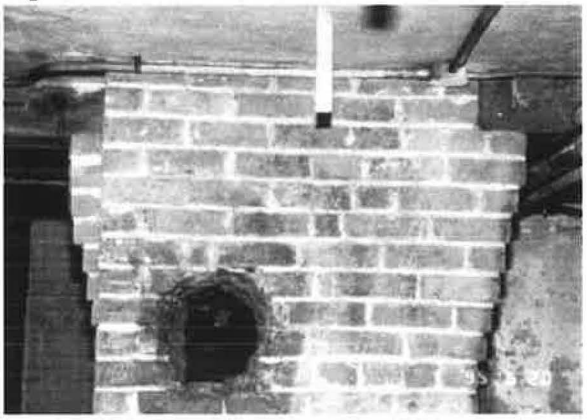
10 John J. Ochman, *Final Report on the Restoration of the Double Keeper's Dwelling, HS-11, Au Sable Point Light Station, Pictured Rocks National Lakeshore, Grant #26-89-LH-26*. Prepared for the U.S. Department of the Interior, National Park Service, Pictured Rocks National Lakeshore (Munising, MI: 1989), 1.

11 Ibid., 8.

12 Ibid., 1.

Part F:
Existing Conditions

Figure 72

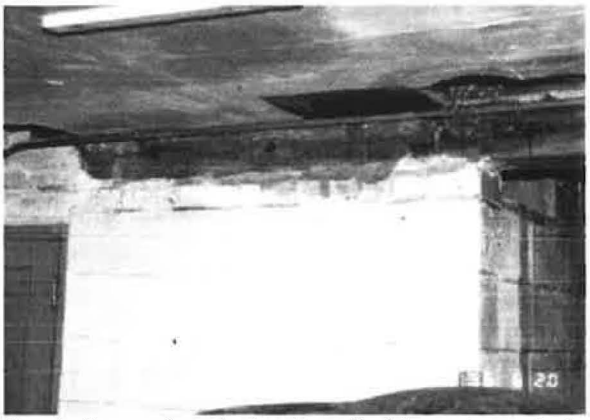


View looking south at the chimney in the basement of the Keeper's Dwelling (HS-09), 1995.

Figure 73

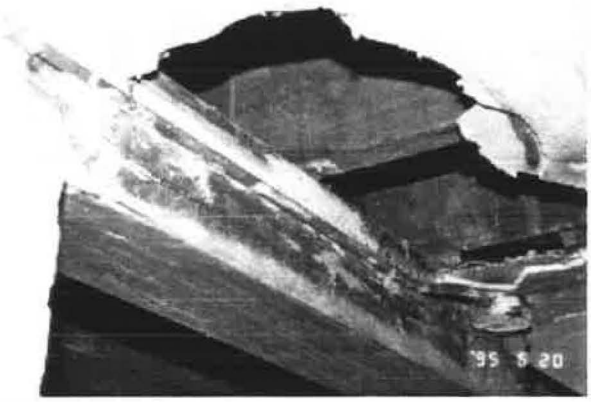
View of the corbelled brick "bracket" at the west basement wall of the Keeper's Dwelling (HS-09), 1995.

Figure 74



View looking south at the interior wall of the coal room in the basement of the Keeper's Dwelling (HS-09), 1995.

Figure 75



View of the butt joint of the first floor joists at the heavy timber beam in the basement, 1995.

Figure 76

Detail view of Windows B-1 and B-2, revealing the sloped joists at the window openings, 1995.

Part F: Existing Conditions

Keeper's Dwelling (HS-09)

Systems Analysis

Structural Framing

Foundation: The foundation walls of the Keeper's Dwelling (HS-09) are 15" thick, comprised of two outer brick wythes, a 3" air space, and an inner brick wythe. Bruce Jones noted the condition of the outer brick wall surface below ground, which was exposed during an excavation he undertook in 1990, stating that, "Beginning at the footing, the wall was covered by a thin white mortar parge or dash coat which, though cracked, extended upward to the underside of the limestone basement window sill."[1]

First Floor Structure: Physical investigation revealed a 7 3/4" x 7 3/4" heavy timber beam, which spans east-west between the brick chimney and the west basement wall, 10' - 7" south of the north basement wall. Eight brick courses are corbelled out from the west face of the chimney to provide a 4 1/2" depth of bearing for the beam, as seen in **Figure 72**. This corbelled brick "bracket" has sagged from the weight of the beam, but during physical investigation appeared to have reached a stable condition. Five brick courses are corbelled out from the face of the west basement wall to provide 4 1/2" of bearing depth for this end of the timber beam, as seen in **Figure 73**. At this bearing point, it appears that the heavy timber beam extends beyond the corbelled brick "bracket" into the masonry wall at an undetermined depth, as shown in Detail A of Drawing S1. In addition to the corbelled brick "brackets," the timber beam is also supported approximately mid-span, 6' - 11" from the west wall, by a 12 1/4" x 12 1/4" brick pier.

A second 7 3/4" x 7 3/4" heavy timber beam spans east-west between the chimney and the east wall of the basement, a total distance of 11' - 11". This beam is also supported at both ends by corbelled brick "brackets". Seven brick courses are corbelled out from the east face of the chimney, providing 4 1/2" of bearing depth for the west end of the beam, as seen in **Figure 72**. At the east end of the timber beam, five brick courses are corbelled out from the face of the east basement wall providing 3 1/2" of bearing depth. At this east wall bearing point, the construction detail appears similar to that at the west basement wall, with the heavy timber beam extending beyond the corbelled brick "bracket" into the masonry wall at an undetermined depth. The concrete block wall of the coal room, constructed in 1919, extends beneath most of the span of the heavy timber beam, as seen in **Figure 74**. Physical investigation indicated that both of these heavy timber beams were of a high grade wood, most likely white oak, with relatively no knots, splitting, or signs of deterioration observed.

The first floor framing is comprised of 1 5/8" x 9 1/2" wood joists spaced 16" on center and span north-south between the exterior walls. Near the center of the basement, the joists meet in a butt-joint at the midpoint of the heavy timber beam, as seen in **Figure 75**. The joists are pocketed into and bear upon the exterior brick walls. The joists, which run perpendicular to and butt up to Windows B-4 and B-5, are cut at an angle beginning 10" from the windows, sloping upward providing a 7" joist depth at the window faces. The ceiling plaster is applied on the angle directly to the joists, as seen at Window B-5, however, the plaster has been removed (probably as part of earlier physical investigation) from Window B-4, as seen in **Figure 76**. The headers at these windows appear to be solid and at least 4" thick. The header at Window B-4 has experienced some deterioration.

Second Floor Structure: The second floor framing is comprised of 1 7/8" x 9 1/2" joists spaced 16" on center, spanning north-south. Based on the configuration of the floor plan at the first floor, it appears that these joists bear onto the interior east-west walls, which extend between the chimney and the exterior walls directly above the heavy timber beams in the basement. The floor joists meet at a butt joint at the approximate center of these of walls. Physical investigation further revealed that the top plate of these interior walls has been cut at two separate locations to allow mechanical ductwork to extend to the second floor.

Attic Structure: The attic floor framing consists of 1 7/8" x 9 1/2" joists spaced 16" on center, which span north-south with 1" x 6" unfinished floor boards laid onto the joists. In addition to the exterior walls, the interior east-west walls at the second floor, which extend between the chimney and the exterior walls, provide bearing for the attic floor framing. The roof framing is comprised of 2" x 5 1/2" rafter joists spaced 16" on center with nailed connections, and meet a 2" x 7" ridge board at each of the hips. The rafters are let into the brick at the top plate of the second floor, as seen in **Figure 77**. There are two roof dormers, one at

the east and one at the west end of the attic. The framing of both are comprised of 2" members of various lengths, as seen in **Figure 78**.

Mechanical

Wood stoves were originally used to heat the Keeper's Dwelling (HS-09). The locations of these stoves are indicated by the faint outlines of the former stovepipe openings (thimbles) on the chimney faces, which have since been patched with plaster. These locations include: the northeast corner of the kitchen (Room 104), the southwest corner of the living room (Room 101), and the southwest corner of the northeast bedroom (Room 201). As indicated in **Figure 79**, hot-air heating was installed throughout the dwelling in 1950, and remained in use until the complex was abandoned in 1958. This heating system consisted of: a gravity-type coal furnace located in the basement; openings for supply air located on the interior frame walls; and, return air grilles located in the floor near the outside corners of the structure. There is also a large return air grille in the floor of the entry vestibule, Room 106. **Figure 79** is a basement plan illustrating the air distribution system, and **Figure 80** shows the furnace and duct system. Pictured Rocks National Lakeshore maintenance records indicate that all ducts were removed, and the associated asbestos was abated, in 1994. Physical investigation also revealed that most of the plaster in the wall areas of the ductwork was removed to allow for the removal of the ducts.

Cooking was first done on a coal burning stove that was located along the north wall of the kitchen (Room 104). In 1949, this freestanding stove was replaced with

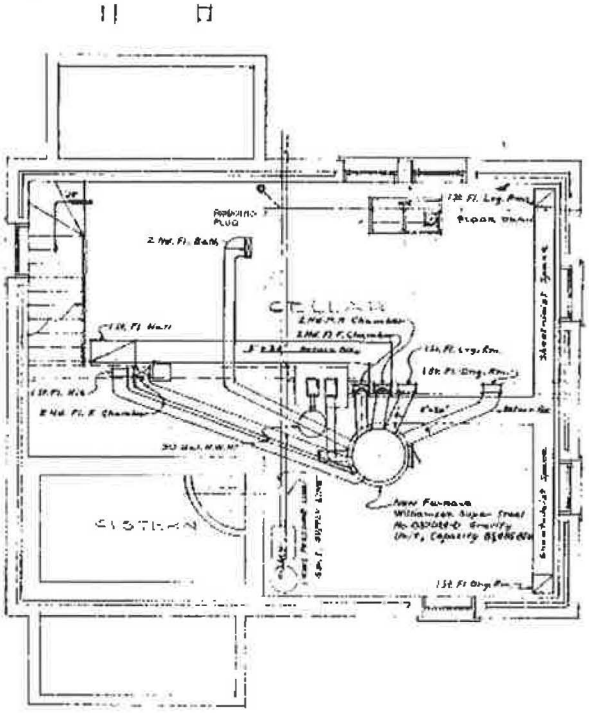
Figure 77

Detail view of the attic rafter joists bearing into the exterior brick wall of the Keeper's Dwelling (HS-09), 1995.

Figure 78

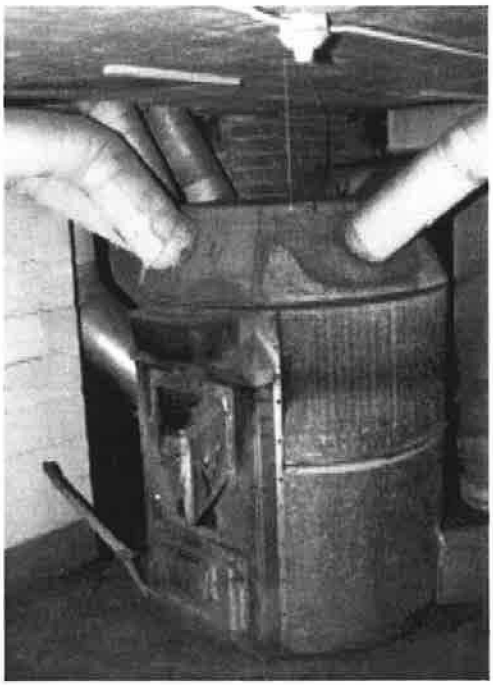
View looking west at the attic framing and dormer construction of the Keeper's Dwelling (HS-09), 1995.

Figure 79



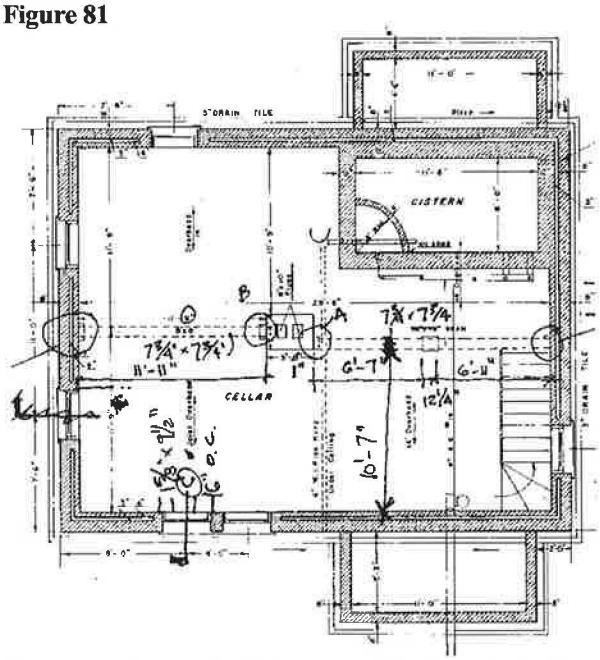
Drawing for modifications to the basement of the Keeper's Dwelling (HS-09) which includes the installation of central heating. Drawn in 1949 with revisions in 1950.

Figure 80



Photograph of the forced air gravity furnace and attached ductwork in the basement of the Keeper's Dwelling (HS-09) prior to its removal, 1990.

Figure 81



Construction drawing for the basement of the Keeper's Dwelling (HS-09). Although undated, it is assumed that this drawing was completed in 1908, as that is the date on the corresponding elevation drawings.

a stove that was located, along with new cabinetry, along the east wall of the kitchen. Furthermore, as stated by Enviroscience, Inc. in their 1991 report, "It is likely that this stove used LP gas as there is a concrete tank stand on the north side of the building and a copper tube running to the floor directly below the stove area."[2]

Plumbing

The structure has two downspouts, which formerly were part of an extensive drainage system, as shown in **Figure 81**. One of the downspouts is located 2'-6" from the south corner of the west elevation and is bent around the limestone water table, with a large rust stain on the limestone. A photograph taken in 1970 (**Figure 82**) by the National Park Service reveals that the downspout was not present at that time, suggesting that the existing one is not historic. Historically, the downspout drained into a metal boot, which was encased in brick, and fed the water directly into the cistern. Now, however, the drain empties onto grade, as seen in **Figure 83**. The other downspout is located approximately at the center of the north wall just east of the north porch. Below this downspout is a metal boot which is no longer used, as seen in **Figure 84**. The downspout once fed rainwater into the boot, which in turn fed into a lead pipe hung from the basement ceiling and then into the cistern located at the southwest corner of the basement. Figure 84 also reveals the hose bibb on the wall just east of the downspout. As was typical in domestic residences during this time period, water was presumably hand-pumped from the cistern to the kitchen sink above.

In 1939, bathroom fixtures were installed in a former storage room at the second floor (Room 205). The associated water pipes were located in the closets (at both the first and second floors) that were adjacent to the east bathroom wall. The pipes are extant, but no longer serviceable and all of the fixtures, excluding the tub at the second floor, have been removed. **Figure 79** indicates that there was a pump with a pressure line adjacent to the cistern which provided the water pressure to the second floor bathroom and upgraded kitchen sink. Presumably this was installed in 1939.

Electrical

Physical investigation of the electrical system was undertaken by Dunham and Associates under separate contract with Enviroscience, Inc. in 1991. In their analysis of the electrical system, Dunham and Associates state that:

Figure 82

View of the southwest corner of the Keeper's Dwelling (HS-09), 1970. Note that the downspout along the west elevation is missing.

Figure 83

Detail view of the brick boot near the south end of the west elevation of the Keeper's Dwelling (HS-09), 1995. The boot originally collected water from the downspout and fed it into the adjacent cistern in the basement.

Figure 84

Detail view of the metal boot and adjacent hose bibb below the downspout along the north elevation of the Keeper's Dwelling (HS-09), 1995.

> The electrical service, wiring and equipment is typical of a 1940s installation. HS-9 had a 60 amp 120/240 VAC electrical service equipment consisting of a 3 conductor cable (#6 AWG) terminating into a splice box. A 60 amp 2-pole fused disconnect switch in turn fed a 12 circuit panel/fuse load center (missing). All basement and first floor branch circuits evolved from this load center. Second floor lights and receptacles are fed from a four circuit fuse box located in the northeast bedroom. All existing wiring is in armored flexible conduit.[3]

The 1944 electrical installation included ceiling mounted porcelain light fixtures, typically one in each room, all of which, with the exception of the one located in the Pantry (Room 103), were removed from the structure prior to the 1995 physical investigation. However, most of the switches and plate covers remained. A ceiling mounted porcelain fixture, with pull cord, remains intact in the Pantry, Room 103.

An unidentified piece of electrical hardware, assumed to be part of the telephone system, was observed at the baseboard on the west wall of the Living Room (Room 101), as shown in **Figure 85**. Much of the exposed conduit attached to the basement ceiling also remains.

The 60 amp electric panel is still in place at the east wall of the basement, just north of the coal room, and there is a stubbed electrical conduit coming into the basement through Window B-3, just north of the panel. There is also a stubbed electrical conduit, which enters the basement at Window B-6, alongside the stair at the west elevation.

Figure 85

View of the typical baseboard and door plinths found throughout the Keeper's Dwelling (HS-09), 1995. The unidentified piece of electrical hardware is assumed to have been part of the telephone system.

Exterior Fabric Analysis

Roof

The roof is covered with stamped sheet metal shingles, which have a raised decorative pattern and are attached to a 3/4" thick spaced wood sheathing, which varies between 9" and 12" wide. This was a common roofing and siding material during the period. The shingles are painted red and show evidence of excessive paint buildup in several areas, which has accelerated paint failure. National Park Service documentation states that the roof has been repaired and painted several times recently, including in 1977, 1981, 1984, and 1989. At several of the areas where the paint has failed and the metal is exposed, generous amounts of rust were observed. In particular, extensive failing paint and resulting rust were observed at the shingles around the vent stack on the south elevation. The lack of evidence of previous nail holes at the sheathing in the attic, combined with the lack of historic documentation of roof replacement, suggests that the stamped sheet metal shingles are the original ones installed in 1909.

The manufacturer of the shingles is unknown. The type of metal used in the existing shingles is most likely an uncoated steel. The shingles are reportedly magnetic, and the extensive rust is consistent with an ungalvanized steel surface. This type of shingle, while extremely durable and fireproof, required frequent painting with red lead or red oxide. This accounts for the paint buildup. The repeated paint failures may be due to high humidity conditions and/or low surface temperatures at the time of painting or to improper surface preparation.

Figure 86

View looking at the south porch of the Keeper's Dwelling (HS-09) where several shingles, especially along the east edge, are pulling loose, 1995.

The pressed metal shingles have interlocking edges, which require minimal mechanical fasteners for their installation. Over the years, this type of fastening has begun to fail, however, as evidenced in Figure 86. This photograph reveals the south porch's roof surface where several of the metal shingles have pulled loose from each other and, as a result, have lifted from the roof substrate. The sides of the two attic dormers are also covered with the same red stamped metal shingles, and have rusted on the south face of the east dormer. The faces of both dormers are covered with wood that is painted white.

The structure has a built-in gutter, often referred to as a "Yankee" gutter, which is comprised of a continuous wood member with a trim piece attached below. This gutter is fastened directly onto the metal shingles along the sloped roof surface approximately 12" above the end of the overhang, and is covered with sheet metal flashing that is painted red to match the adjacent metal roof surface. The paint, however, has failed due to buildup in several areas, leaving the metal exposed and accelerating oxidation. The wood trim along the underside of the gutter, not covered with metal flashing, appears to have uniformly weathered across its entire surface, at the main roof and at both of the porch roofs. The paint on the wood surface of the gutter itself has also failed in several areas, and there is evidence of rot in several locations.

The chimney is comprised of red vitrified brick identical to that found at the wall surfaces below, and has a simple concrete cap. There are some areas of lighter mortar visible on the chimney, indicating that tuckpointing was done. National Park Service maintenance records show that it was, in fact, undertaken in 1984. Furthermore, extensive water damage at the interior surfaces suggests that either the flashing at the chimney was improperly installed or that it has deteriorated. It is likely that both are the cause.

Walls

All of the exterior walls are 15" thick, consisting of two outer brick wythes, a 3" air space, and one inner brick wythe. The exterior brick wythe is vitrified red brick laid in common bond with one header course for every six stretcher courses. At the interior, plaster deterioration has exposed the inner brick wythe in several locations, revealing that it is common red brick.

There are three distinctive horizontal bands, which extend around the entire perimeter of the Keeper's Dwelling (HS-09). The lowest is a limestone water table, approximately 3'-0" above grade (which fluctuates due to wind drifting sand). There is a continuous belt course, which is level with the window sills of the second floor, and is comprised of two brick courses, which protrude approximately 1" from the adjacent brick surface, and have a sloped mortar wash. Further, the top five brick courses of the exterior walls also protrude approximately 1" from the adjacent brick surface, forming a frieze.

Openings

All of the existing window sashes are wood and one-over-one double-hung, with the exception of the two attic dormer windows which have awnings with a diamond muntin pattern. All of the windows have stone sills, which protrude from the wall faces approximately 1", and flush stone lintels. The sill of the smaller window at the porch (Window 1-8) is painted gray, as are the two door sills. The rest of the window sills are unpainted, and the window just east of the porch (Window 1-9), has dark gray mildew stains on the surface of its lintel. During the 1995 physical investigation, all of the windows also had eight-pane, dark green wood storms, constructed and installed by the National Park Service. Although dark green was a standard Lighthouse Service color for window storms and screens, there is no indication, either written or photographic, that the storms were historically multi-paned at Au Sable, as the existing ones are.

Figure 87

Detail view of the northwest corner of the north porch of the Keeper's Dwelling (HS-09) revealing the extensive efflorescence at the brick above grade, and the spalled brick at the area that was formerly below grade, 1995.

Porches

The dwelling has two identical porches, one each on the north and the south elevations. The red brick half walls which surround the porches extend approximately 4' - 6" above grade. Each wall has a 3" x 10" concrete cap, both of which are painted gray and have several areas of minor chipping and cracking. These brick half walls are laid in stretcher bond with one header course at the top of the wall just below the concrete cap. The concrete slab deck at both porches is approximately 21" above grade and reached by three concrete steps. Both of the concrete decks and steps are coated with several layers of gray paint, however, they have only experienced a few hairline cracks. Both the ceiling and the ends of the shed roof at each of the porches are covered with 3" wide beaded boards, and have an excessive amount of paint buildup, which has resulted in failure and cracking. The large decorative brackets are also coated with several layers of paint, however, there was no evidence of visible failure during the 1995 physical investigation.

At the south porch, there are signs of efflorescence on the south face of the porch wall east of the steps, and there is loose, missing, and cracked mortar near the floor slab at the west end of the wall. At the north porch, there is an area of missing concrete at the northeast corner of the bottom step. There is also an area of loose and missing mortar on the north face of the wall just east of the steps. West of the steps, there is extensive efflorescence and spalling brick, as seen in **Figure 87**.

Trim

Maintenance records indicate that all of the exterior wood surfaces at the Keeper's Dwelling (HS-09) were painted (white) by the National Park Service in 1977, 1981, 1984, and 1989.

Specific West Elevation Conditions

Lichen is visible in patches on the brick, and has grown thickly on the limestone water table. There is also a 4' x 1' - 6" concrete slab which sits just a few inches from the building at grade, north of the downspout. It is not known for what the slab was used.

There are signs of efflorescence at the north end of the wall between the water table and the belt course, and some of this area has also experienced cracking at the mortar joints. The white, powdery efflorescence is the surface deposit of mineral salts naturally present in the brick. When water migrates through a brick wall, these salts are dissolved and redeposited on the brick's surface as the water evaporates. To some extent, this process is unavoidable with any masonry construction. However, the extensive efflorescence on all elevations suggest an underlying moisture problem, probably related to the roofing failures discussed above. This situation allows rain water to enter the cavity wall from above. The moisture must then migrate through the inner or outer brick wythes, as the walls are not properly fitted with weep holes.

Specific South Elevation Conditions

There is a metal coal chute in the basement window opening at the east end of the dwelling (Window B-1). The chute is smaller than the original opening. The original sill remains, but the area of the opening around the metal chute has been infilled with a vitrified red brick, very similar to the adjacent original brick.

Specific East Elevation Conditions

There are several small holes in the brick, and in the mortar joints below the stone water table between Window B-2 and the south end of the wall, which have been filled with concrete. There is also efflorescence at the east elevation, as indicated by the white "spidering" pattern on the brick surface at the south end of the wall between the water table and the brick belt course.

Specific North Elevation Conditions

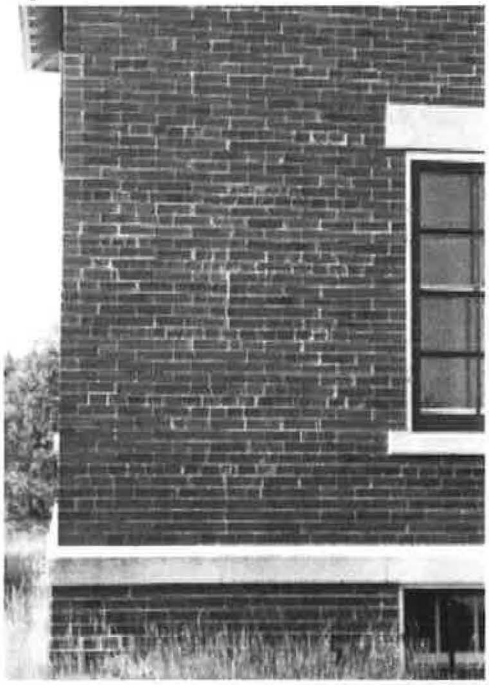
There is an excessive amount of efflorescence, indicated by a white, 'spidering' pattern at the brick surface almost the full height of the north elevation near the west end, between the water table and the brick belt course, as seen in **Figure 88**. There is also a horizontal crack in the sill of Window 2-4 which has been patched with a concrete compound.

Interior Fabric Analysis

Basement

The wood stairs leading into the basement along the west foundation wall of the dwelling are covered with paint buildup, however, the paint has worn from the center traffic area. There is no handrail on either side of this open-sided stair, and the stair slopes toward the exterior wall, however, it appears to have reached a

Figure 88



View of the north wall of the Keeper's Dwelling (HS-09) revealing the extensive efflorescence of the brick, 1995.

Figure 89

View looking north into the basement of the Keeper's Dwelling (HS-09), 1995. Note the spalling plaster and deteriorated finishes at the exterior walls.

stable condition. The plaster wall surface above grade along the north wall of the stair has spalled and deteriorated excessively, and below grade the paint has failed at the brick surface, as seen in **Figure 89**.

The basement walls are red brick laid in common bond with a header course between every six stretcher courses. The basement walls are covered with several layers of white paint, while the bottom few brick courses are painted gray to represent a baseboard. According to the construction drawing for the structure, the basement walls rest on 12" concrete footings, which are approximately 77" below grade. The mortar is either missing or loose at the bottom three to four courses of the north wall, indicating water infiltration. Archeological investigations undertaken by Mark Chavez in 1990 revealed that the parge coat at the exterior face of the basement walls had deteriorated in several places, resulting in the water infiltration. Despite the good drainage offered by the sandy soils at the site, water can and will infiltrate the permeable masonry. This process is made easier by a deteriorated parge coat, the purpose of which is to provide a less-permeable "vapor barrier". While there were no signs of standing water in the basement at the time of the survey, high humidity conditions, air pressure differentials, and time are all enough account for the visible moisture damage.

The entire ceiling of the basement is covered with rough plaster attached to plaster board on 7/8" furring strips. There are several areas where this plaster has either been damaged, has deteriorated, or was removed to install pipes or other fixtures.

The coal room, constructed in the southeast corner of the basement in 1919, has two interior walls comprised of unfinished concrete blocks with a top course of yellow brick. The 1995 physical investigation revealed that a significant amount of coal had been left in the room. The door into the coal room is solid wood with a two-panel configuration. The angled wood slats along both jambs, which span the full height of the opening, are in good condition with no signs of damage or paint buildup.

Physical observation revealed an opening near the top of the east wall of the cistern, which was covered with a thin coat of plaster and plastic. This was a 'manhole' which provided the only access into the cistern for any

needed repairs. Just north of this opening, the lead pipe, which once led water from the exterior downspout, feeds through this wall into the cistern. There are also several openings in the floor adjacent to the north face of the cistern, which are remnants of the drainage system that diverted excess water from the cistern to the lake.

Conditions at First and Second Floor

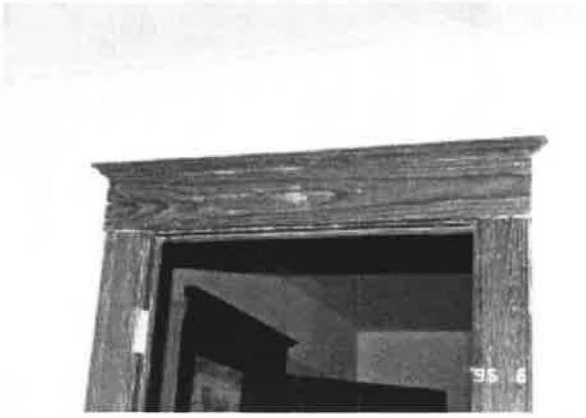
Openings: The interior wood trim throughout the dwelling is a molded pilaster finish trim, which is repeated at all of the openings. It consists of a thin wood pilaster rising from base blocks at the doors, and from stools at the windows, and meets the corner blocks at the head of either the doors or windows. The entire casing is tied together by a molded head casing, as seen in **Figure 90**. This type of trim is a typical feature of vernacular architecture of the late 19th and early 20th centuries. Furthermore, the same trim can also be seen at several other light stations around the Great Lakes, including the Raspberry Island Light Station in the Apostle Islands and the Northport Lighthouse on Lake Superior.

Windows: Each of the window openings in the basement has a sloped mortar wash between the exterior wool sill down to the interior brick sill surface. At most of the first and second floor windows, there are two sets of metal hardware indicting two differing types of treatment.

Doors: All of the interior wood doors are five-panel, and have a horizontal configuration. This type of configuration of door panels was popular in residential architecture from 1891-1940, and was also popular in light station dwellings around the Great Lakes. All of the doors are 1 1/4" thick and 32" wide. The doors are 83 1/2" tall at the first floor and 79 1/2" tall at the second floor. One exception is Door 105.2, between the Entry Vestibule (Room 106) and the Hall (Room 105). Although it is no longer present, the door opening and frame indicate that the door was 36" wide, 84" tall, and 1 3/4" thick.

The interior door hardware sets appear to have been the same throughout the dwelling, and are comprised of black baked-on enamel knobs, each with a brass plate and mortise lock set. Further, each door had 1 1/2 pairs of ball-top hinges. Where needed, each door had a turned wood stop, 1 1/2" in diameter, attached to

Figure 90



View of the opening at Door 101.3 showing the typical door trim found throughout the Keeper's Dwelling (HS-09), 1995.

Figure 91

View of the typical baseboard and door plinths found throughout the Keeper's Dwelling (HS-09), 1995. The unidentified piece of hardware may be from the telephone.

the baseboard of the adjacent wall, most of which remain intact.

Trim: The baseboard throughout the dwelling is a three member molded base, with small blocks at the interior corners and miters at the exterior corners, a typical mill profile of the early- and mid-19th century. This baseboard, shown in Figure 91, was used in several dwellings at light stations around the Great Lakes. At areas of the exterior walls, where the baseboard has pulled loose from the wall surface, it was observed that the wall plaster extends down to the floor level. This is a typical detail at all of the exterior walls of the Keeper's Dwelling (HS-09), however, at the interior partition walls, the plaster ends just below the top of the baseboard, with a wood nailing board attached to the framing for the attachment of the baseboard. There are also several

turned wood corner beads at the outside corners of the plaster walls within the dwelling.

Floors: As observed at areas of missing plaster in the ceilings below, the maple flooring throughout both the first and second floors rests on a subfloor, which consists of 7/8" thick boards laid diagonally.

First Floor

Room 101, Parlor or Living Room

Floor: The floor consists of 2 1/4" wide x 3/4" thick maple tongue-and-groove boards laid in an east -west direction. The flooring continues through the threshold, uninterrupted at both door openings, into the room, however, a distinctive line at the threshold of both Door 101.2 and Door 101.3, indicates that the floor was stripped in Room 101, but was not in Rooms 102 and 105. There is also a 14" x 16" hole cut through the floor structure near the northeast corner of the room, which formerly served as a return air grille.

Walls: Both the finish plaster and the plaster board are missing from most of the south wall's surface west of Door 101.2, thereby exposing the wood framing. This missing plaster was likely removed in conjunction with the removal of the air duct (by the National Park Service), which had been located within the wall. The spalling plaster at the chimney face (**Figure 92**) at the southwest corner of the room appears to be the result of water infiltration at the chimney, due to improper or deteriorated roof flashing. The top portion of the wood baseboard is missing along a portion of the south wall, and along the entire north wall of the room. Both of the exterior walls in the room have experienced excessive water damage, and much of the plaster is completely missing. In the area where the plaster still remains, it is detached from the brick, and bows away from the surface over 8" in depth. The plaster is also deteriorated or missing across the entire north wall, as seen in **Figure 93**. An area of missing plaster around Windows 1-4 and 1-5 exposes the brick wall, revealing that the interior window openings are supported by arched brick heads rather than by stone lintels, (which is what supports the opening at the exterior brick wythes). Although several areas appear to have been stripped, all of the wood trim in this room, including the baseboard, and the door and window trim, appear to have been painted, as seen in **Figure 94**.

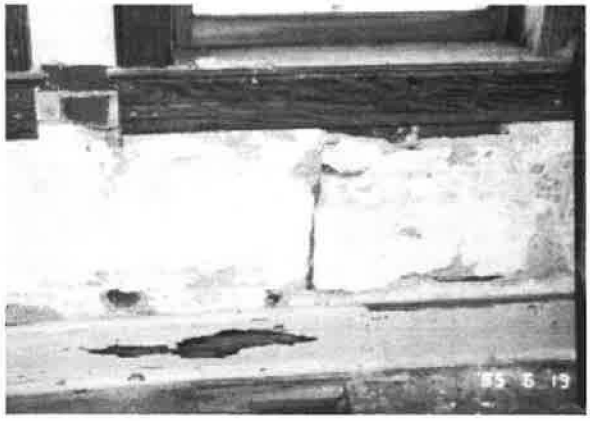
Figure 92

View of the deteriorated plaster due to water infiltration at the southwest corner of the Living Room (Room 101), which is the chimney face, 1995.

Figure 93

View looking at the northeast corner of the Living Room (Room 101) of the Keeper's Dwelling (HS-09), 1995. Note the deterioration of the interior finishes.

Figure 94



Detail view of the spalling and deteriorated plaster below Windows 1-4 and 1-5 in the Living Room (Room 101) of the Keeper's Dwelling (HS-09) due to water infiltration at the window opening, 1995.

Ceiling: Cracking and water stains in the plaster surface are evident at the southwest corner of the ceiling near the chimney, which appears to be a result of the water infiltration at the chimney.

Room 101A, Closet

Physical investigation revealed both minor and major diagonal cracking of the plaster, which is indicative of settlement. Also, at the west (rear) wall of the closet, there is a wood hook rail with a few metal hooks remaining.

Room 102, Dining Room

Floor: Three distinctive concentric rectangular markings in the floor finish denote the previous locations of three different sized pieces of floor coverings, such as varnished canvas or Linoleum. As was customary in the Lighthouse Service, floor finishes were applied around the floor covering, and based upon the bare wood at the center of the room, the first layers of stain were applied after a floor covering was in place. There is also a 14" x 16" opening cut in the floor at the southeast corner of the room, near Window 1-1, which previously housed a return air grille.

Walls: The wood baseboard along the east and south walls of the room has experienced excessive water damage, including dry rot and splitting. The plaster surface at both the east and south walls has also experienced excessive deterioration, and several areas of plaster are missing from the east wall, exposing the underlying brick surface. The deterioration also extends to the plaster at the upper east corner of the north wall. There is horizontal cracking along the west wall, in addition to spalling plaster at the chimney face, both of which are conditions indicative of water infiltration at the chimney. Physical investigation revealed that the turned wood corner bead on the chimney has been stripped of its paint finish, and that the wood surface is dry and weathered. In addition, the 1995 physical investigation revealed a demarcation in the paint along the entire east wall, and along the south wall to Window 1-1, indicating the previous location of a picture rail.

Ceiling: The 1995 physical investigation revealed the wiring from the ceiling mounted light fixture at the center of the room. In addition, the plaster at the northwest corner of the ceiling near the chimney is deteriorated, presumably due to water infiltration.

Room 103, Pantry

Floor: The 1995 physical investigation revealed that most of the floor finish is worn off, except at the perimeter of the room, which is coated with several layers of stain and varnish.

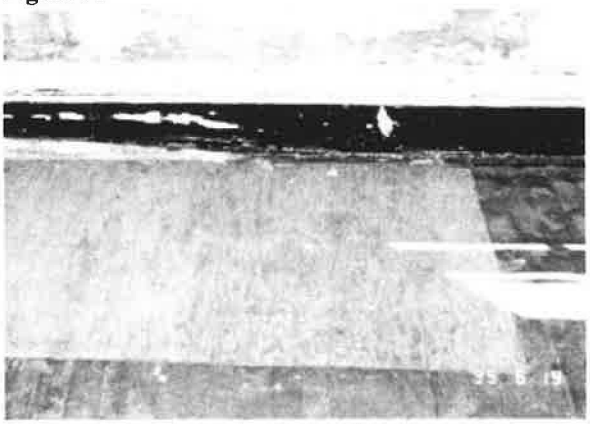
Walls: The wood shelves, which line the west wall, are crudely installed, and have minimal layers of stain, with several nicks, gouges, and stains on the shelves from frequent use. There is also the ghosted image of a shelf at the east wall, which is no longer extant. There is a vertical crack, which extends the full height of the room at both of the exterior corners, indicative of the settlement of the building. The vent stack for the kitchen sink extends through the west wall from the kitchen, and up through the ceiling.

Ceiling: There are several minor cracks in the ceiling plaster, which appear to have been caused by the uneven settlement of the building.

Room 104, Kitchen

Floor: The floor boards run east - west, and there is an area, approximately 2' - 6" deep, along the west wall at the southwest corner of the room, which had rotted and was patched with a piece of plywood in 1977 by the National Park Service, as seen in **Figure 95**. Also, a significant area of the floor boards around the exterior door opening, (Door 104.2), appear extensively weathered and have 'cupped.' In addition, the wood threshold at Door 104.2 is weathered and the edges are rounded due to wear. As discussed in Part D of this report, dark staining and a butt joint in the floor boards

Figure 95



View of the plywood patch in the wood flooring at the southwest corner of the Kitchen (Room 104), 1995.

Figure 96

View of exposed framing at the top of the north wall of the Kitchen (Room 104) of the Keeper's Dwelling (HS-09), 1995. Note that the top plate has been cut and removed to allow ductwork to extend to the second floor.

at the northeast corner of the room indicate the location of a former wall.

Walls: A large area of the plaster and the plaster board is missing from the south wall, removed in conjunction with the removal of the air duct in this location. **Figure 96** shows this area, indicating that the top plate of the wall was removed to allow the air duct to extend to the second floor, a detail typical of the air distribution system of the Keeper's Dwelling (HS-09).

The shoe mold is missing from the baseboard around the entire perimeter of the kitchen, and, along the east wall, the entire baseboard is missing. The baseboard along the entire west wall is extremely damaged and one section is missing. The paint pattern at the baseboard in this room is unique to the building; the bottom portion is painted black while the top is painted white, as seen in **Figure 95**. At the area where the kitchen base cabinets were previously located, the baseboard is entirely white, suggesting that the paint scheme changed to black and white after the installation of the kitchen cabinets in 1949. At the east end of the room, including both faces of the chimney, and the wall against the pantry, most of the paint has been stripped off of the baseboard.

The plaster surface of the entire west wall, and the west end of the south wall, has extensive water damage resulting in the spalling and deterioration of the plaster, as seen in **Figure 97**. The finish coat of plaster has been pulled off of the east wall in several locations,

Figure 97

View of Door 104.2, indicating that the exterior of the door has been stripped and refinished, and non-period hardware installed, 1995.

which appears to have been the result of the removal of the kitchen cabinets. Also, the wood door casing is missing from the east side of Door 104.2. Further, the profile of the former stovepipe opening on the west chimney face is discernible, although it has been plastered over, and the plaster has begun to spall due to water infiltration.

The likely source of the moisture that has damaged the plaster in this room, and others in the building, is water vapor migrating through the masonry walls. The south and west walls of the kitchen, which show the most extensive plaster damage, are exterior walls. While interior humidity levels, lack of ventilation, and condensation may play a role in this damage, the conditions at the roof, the soft mortar joints, and the lack of weep holes at the exterior cavity walls are the major contributing factors.

While cavity walls offer some degree of protection against water infiltration, all masonry is permeable to water and the air space separating the inner and outer wythes of a cavity wall will not block water vapor. Thus, under certain conditions of humidity and changing air pressure, water vapor can penetrate a cavity wall fairly

easily, migrating from the exterior wall to erupt behind plaster or other interior finishes. This has occurred throughout the masonry structures at Au Sable Light Station. The closure of the station, without heat, ventilation, or maintenance, contributed to the moisture problems.

Room 105, Central Hall

Floor: The floor boards are laid in an east-west direction, and have significant varnish buildup on their surface, which has caused the stain to crack and loosen in an alligatored pattern. The large return air grille, approximately 1' - 6" x 3' - 0", at the southeast corner of the room, has extensively rusted.

Walls: The outside corner of the north wall at the stair has a turned wood corner bead, which has significant stain and varnish buildup. The top layer of paint on the walls in this room is yellow, however, at the south wall the yellow paint ends a few feet below the ceiling with white paint above. This change in finish is indicative of the presence of a picture molding, however, one was not present during the 1995 physical investigation. The plaster surfaces of both the south and east walls have experienced water damage including mildew stains, peeling paint, and spalling plaster. Further indications of moisture damage include an extensive amount of mildew stains at the west wall, and a rusted metal hook attached to the stair. There is a deep horizontal crack, approximately 3' - 6" above the floor, which extends the full width of the south wall and has a water stain around it, indicating that water was seeping through the crack for long periods of time.

Stair: The stair to the second floor is at the west end of the room. The first landing, two steps above the first floor, is covered with 2 1/4" wide tongue-and-groove boards laid in a north-south direction. The stain and varnish finish on the stair has mostly worn off at the central traffic path, and appears to have been followed by years of weathering of the unprotected wood surface due to the lack of heating and moisture control in the building. However, there is extensive stain and varnish buildup, as evidenced by an alligatored pattern of cracking, at the balustrade, including the newel post. The wood wall stringer has pulled loose from the wall and has itself, split into two separate pieces. Both of these conditions are indicative of water vapor infiltration at the wall.

Figure 98

View looking north at the ceiling in the entry vestibule (Room 106) of the Keeper's Dwelling (HS-09), 1995. Note the deteriorated plaster and paint that has come loose from the wood door casing.

Room 106, Entry Vestibule

Floor: The floor boards are extensively weathered, and most of the stain and varnish have worn off.

Walls: There is a significant amount of plaster deterioration at the north wall, and there are several stress cracks radiating from the head of Door 106.1. There is also a vertical settlement crack extending the full height of the wall at each of the corners of the room. There is also a deep horizontal crack in the plaster, approximately 2' - 0" above the floor, which extends the full width of the east wall. There is another horizontal crack, approximately 5' - 6" above the floor, which extends the full width of the west wall. The paint finish of the wood trim in the room, including the baseboard and door casings, has either been stripped or has significantly worn off in several areas. The 1995 physical investigation revealed that the wood is extremely weathered and rotten in several areas, with deep cracking along the grain. However, no damage was observed at the wood shelves along the east elevation, which are painted dark green, and have circular saw marks visible on their edges. There is also a faint demarcation in the paint at the west wall, indicating the location of an additional shelf, which is no longer extant.

Ceiling: The plaster ceiling has experienced a significant amount of damage indicative of water infiltration, including excessive cracking and surface water stains. Furthermore, a significant portion of both the plaster and plasterboard lath is missing from the ceiling along the north wall, thereby exposing the wood furring strips to which it was attached, as seen in **Figure 98**.

Second Floor

Room 201, Northeast Bedroom

Floor: The floor boards are stained and varnished, and, with the exception of two circular demarcations (dark stain and indentation of unknown origin), the floor shows no apparent signs of deterioration or damage.

Walls: There is a vertical settlement crack, which extends the full height of the wall at the southwest corner of the room where the chimney meets the west wall, and both faces of the chimney have experienced some minor plaster spalling. Both of these conditions appear to be the result of water infiltration due to either improper installation or the lack of flashing at the roof. In addition, there is a turned wood corner bead at the outside corner of the chimney, which has some stain and varnish buildup.

Ceiling: The plaster ceiling has experienced a significant amount of damage, including excessive cracking, spalling, and surface stains, especially near the southwest corner of the room. This condition is indicative of water infiltration.

Room 201A, Closet

Physical investigation revealed minor diagonal cracks in the plaster at the walls, a condition which is indicative of building settlement. Also, there is a wood hook rail with metal hooks along the back (west) wall.

Room 202, Southeast Bedroom

Floor: The floor boards are laid in an east-west direction, and almost all of the paint finish has worn off of them.

Walls: The plaster surfaces at the south and east walls, (both exterior walls), have experienced minor deterioration, including spalling and plaster pulling loose from the brick surface. Furthermore, there is a deep horizontal crack in the plaster, approximately 7' - 0" above the floor, which extends across the entire south wall. The color of paint at all of the walls, except the chimney faces, changes at approximately 16" below the ceiling, indicating the previous location of a picture molding. Physical investigation by Douglas Walter in 1978 revealed the profile of the picture molding outlined on the side of the window trim. There is also a demarcation of the profile of a turned wood corner bead in the paint at the outside corner of the chimney in the northwest corner of the room.

Room 202A, Closet

The exposed vent stack from the kitchen sink below extends from the floor through the ceiling at the north end of the closet. There is also a vertical settlement crack, which extends the full height of the wall at both of the exterior corners of the closet. There is a wood hook rail with metal hooks along the back (west) wall of the closet.

Room 203, Southwest Bedroom

Floor: No signs of deterioration were observed at the floor boards, which are stained and varnished.

Walls: The walls are painted a light blue, with a change in color (white) 16" below the ceiling, indicating the previous location of a picture molding. There is a horizontal crack in the plaster, approximately 4' - 0" above the floor, which extends the full width of the north wall. There is also a vertical settlement crack, which extends the full height of the wall in the northwest corner of the room. There is a deep horizontal crack in the plaster, approximately 5' - 0" above the floor, which extends the full width of both the south and west walls. There is deterioration below Window 2-9, including spalling and cracking on the south wall. Both of theses conditions are indicative of water infiltration at the window opening.

All of the wood surfaces in this room, including the window and door trim, and the baseboard, have a significant amount of stain and varnish buildup. There is a 14" x 16" hole cut through the north wall and baseboard indicating a previous air duct opening, a detail typical of the air distribution system of the Keeper's Dwelling (HS-09). Additionally, the wood baseboard has pulled loose from the wall surface along the west wall, and a portion of the south wall.

Room 203A, Closet

There is a vertical settlement crack, which extends the full height of the wall at both of the exterior corners of the closet. There is also a wood hook rail with metal hooks along the west (rear) wall.

Room 204, Hall

Floor: There are two circular demarcations (consisting of staining and indentations of an unknown origin) in the floor boards.

Walls: There is a vertical settlement crack, which extends the full height of the wall at the southwest corner

of the space above the stair landing. In addition to several mildew stains, there are also two horizontal cracks, approximately at the third points of the wall, which extend the full width of the south wall. Furthermore, the plaster surface at the south end of the east wall has experienced deterioration, an indication of water infiltration at the chimney. There is a buildup of stain and varnish, as evidenced by an 'alligatored' pattern of cracking, at the wood baseboard, the door casings, the recessed ship's ladder leading up to the attic, and at the edges of the turned wood corner bead on the outside corner across from Door 201.1. The finish has worn off most of the turned wood corner bead (except at the edges) exposing the bare wood, which appears to be very dry.

Stair: The stair runs alongside the west exterior wall, and extends down to the first floor. The plaster surface across this entire wall has experienced an extensive amount of spalling and deterioration and there are two horizontal cracks which span its full width.

Ceiling: Cracks were observed throughout the ceiling surface. In addition, the plaster has spalled at the southeast corner of the ceiling, indicating water infiltration at the chimney.

Room 205, Bathroom/Former Storage Room

Floor: The floor is worn and there are several nail holes, presumably from the installation of the previous linoleum floor covering. There is a hole cut through the floor, and a demarcation on the floor boards from the toilet in the northeast corner of the room, which was removed by the National Park Service.

Walls: There has been excessive water infiltration at Window 2-6 on the north wall, as evidenced by the spalling plaster below the window opening, and the horizontal cracks extending from the sill. There are several holes in the plaster and in the framing of the south wall; the remaining evidence of the former location of the sink, medicine cabinet, light fixture, and accessories.

Ceiling: There is evidence of a ceiling light fixture, which was present during the 1990 physical investigation, but which had been removed prior to the 1995 physical investigation. Additionally, minor plaster cracks covering the entire ceiling surface were observed during the 1995 physical investigation.

Architectural Barriers

There are several architectural barriers which limit handicapped accessibility at the Keeper's Dwelling (HS-09). Both of the porches at the entrances into the building are approximately 2' - 6" above grade, and there is an additional 5" step (3" step with a 2" threshold) between the porch and the first floor level. Both of the exterior doors are 36" wide, thus allowing proper clearance, however, the existing hardware is not adequate for persons with disabilities. Furthermore, upon entering the building at the north entrance, one enters a small entry vestibule (Room 106) which is too small to provide the 60" diameter clear space required to sufficiently be accessible to persons in wheelchairs. On the other hand, if one enters the building at the south entrance, the entire first floor (with the exception of Room 106) is accessible, with sufficiently wide clearance at all door openings.

Tower (HS-10)

Exterior Fabric Analysis

Above grade, the base of the tower consists of large cut-stone blocks, approximately 12" in height. Most of these blocks are approximately 3'-0" long, however, some are as long as 8' - 0", all of which curve to form the circumference of the tower while tapering slightly upward. The faces of the stone blocks have a bush-hammered finish, similar to that found at the original limestone window sills of the attached Double Keepers' Duplex Residence (HS-11). However, the blocks are covered with several layers of gray paint, thus diminishing the appearance of the surface treatment.

Below grade, the blocks of the tower's base are not as uniform, as evidenced by archeologist Bruce Jones during his 1990 excavation at the foundation. He states that:

> The foundation of HS-10 gradually expanded in diameter below the ground surface. The above-ground cut-stone blocks were underlain immediately beneath the sod layer by multiple courses of large, roughly dressed, rectanguloid sandstone, limestone, and granite blocks. Mortar joints in this portion of the foundation varied considerably in thickness, compensating for the greater irregularity of the building materials.[4]

Physical investigation revealed that the red brick wall of the tower is covered with several layers of whitewash. National Park Service maintenance records

indicate that several areas of the exterior masonry were tuckpointed and then covered with three layers of whitewash in 1983 and, again, in 1987. Due to buildup of the whitewash, the definition between the mortar joints and bricks is not discernible in many areas, and the top layers of whitewash have begun to show evidence of failure, including cracking and peeling. The brick surface above the gallery deck, (which is the lantern base), is painted black, and the 1995 physical investigation revealed that the black paint is peeling in many areas, exposing several layers of whitewash underneath.

The lightning protection at the tower consists of a 3/4" diameter 'gas pipe,' which extends from the metal parapet deck down alongside the exterior of the northwest face of the tower, and into the ground. Along the white-painted brick surface, the lightning cable is painted a contrasting black while, along the tower's base, it is painted the same gray as the adjacent stone block surface. There is also a vertical stain, which extends up approximately 3/4 of the height of the southeast face of the tower. Although this staining is currently faint due to new layers of whitewash, it may be the result of an earlier lightning protection system.

The drainage system at the tower lantern consists of five small built-in spouts at the edges of the flared eaves, which divert water from the roof. The 1990 physical investigation revealed that these spouts, in addition to the roof, were in poor condition. The National Park Service repaired the lantern in 1989 - 1990, and no signs of deterioration were observed during the 1995 physical investigation.

The exterior metal gallery deck has extensive paint buildup, evident by its rough surface. National Park Service records indicate that all of the metal surfaces at the tower were painted in 1983 and 1987. Further, this buildup has led to areas of failure, exposing rust at the handrail and balustrade.

Interior Fabric Analysis

Ground Level

The floor at the ground level of the tower consists of interlocking stone blocks which are painted gray. The interior face of the walls are covered with a rough plaster, which is directly applied to the brick surface and is whitewashed. At the very bottom of the plaster walls near the ground floor, approximately the bottom 8" of plaster are painted the same gray color as the stone floor, simulating a baseboard trim.

Watchroom

There are three round top windows at this level of the tower. Each window is recessed in a round top niche, which extends from the floor level of the watchroom up around the window. In each of the three niches, the plaster has cracked around the entire perimeter of the window opening. This appears to be the result of uneven settlement between the wood window frame and the brick wall. Further, there is extensive staining, cracking, and deterioration of the plaster below the east window, indicating water infiltration at the window opening.

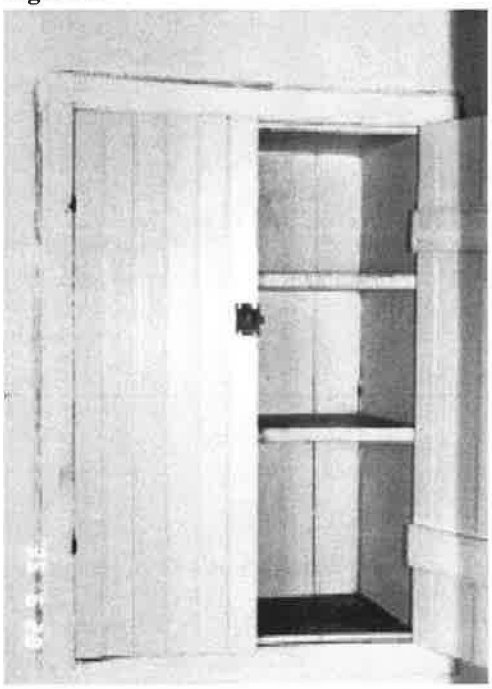
There is a cabinet built-in into the southwest portion of the tower wall, the sides of which are plaster and the back of which is lined with 5" wide beaded boards. The shelves in the cabinet are painted gray and the walls are painted white. The doors of the built-in cabinet consist of 2" wide, vertical beaded board which curve to match the curvature of the adjacent tower wall, and only half of the brass lock set is extant. There is a simple 1 3/4" wood casing around the perimeter of the cabinet opening, as seen in Figure 99. The 1995 physical investigation revealed that the cabinet has recently been painted a beige color, a color which is inconsistent with the findings of the paint analysis undertaken in 1990.

Lantern Room

Floor: Access into the lantern room from the stair below is obtained through a hatch door in the floor. The hatch door and frame are metal and have experienced some rust. There is a wood stop, on the wall adjacent to the door opening, on which the door rests when it is in the open position.

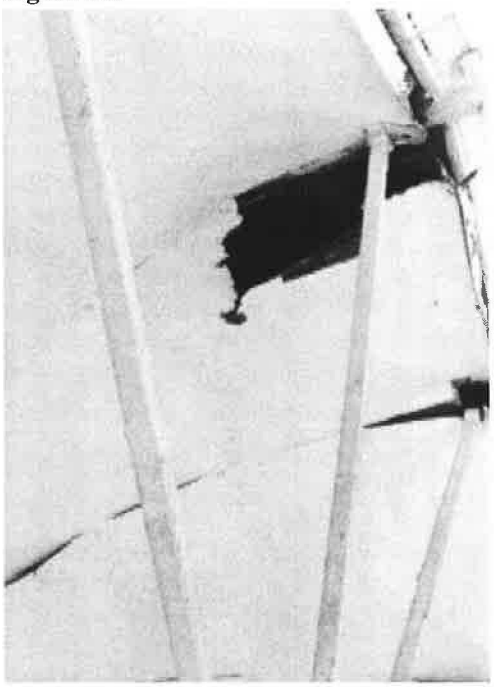
Ceiling: As described in the 1909 *Description of Buildings, Premises, Equipment, Etc., at Au Sable Light-Station*, the ceiling of the lantern room is comprised of a, "..copper dome lined with zinc held with pinching strips of wrought iron."[5] Physical investigation in 1990 revealed that water had penetrated this roof structure and corroded through the zinc ceiling, as shown in **Figure 100**. The National Park Service repaired this damage in 1992, and no damage or deterioration was evident during the 1995 physical investigation, as seen in a photograph of the restored space, **Figure 101**.

Figure 99



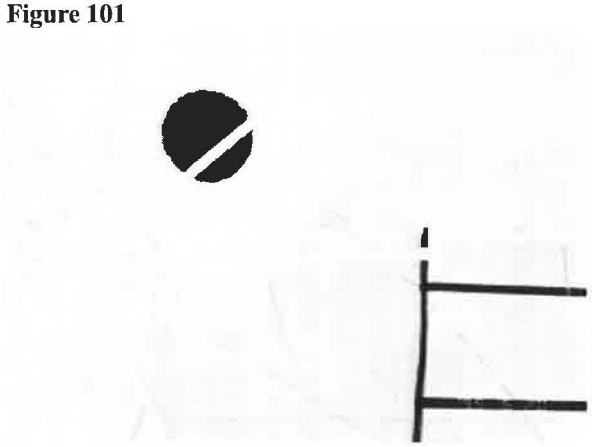
Detail view of the built-in cabinet in the watchroom of the tower, 1995.

Figure 100



View looking up at the metal ceiling of the lantern room in 1990. Note the large holes where the metal has corroded due to water penetration through the roof.

Figure 101



View looking up into the ceiling of the lantern room in 1995, following its restoration.

Walls: The walls of the lantern room are covered with a wood wainscot, comprised of vertical beaded boards. The 1995 physical investigation revealed a large vertical split in the wood along the southwest face. Several of the boards have rotted near the floor, indicating water damage either from water vapor passing through the exterior wall or from condensation on the interior wall surface due to high room humidity combined with cool wall temperatures. The metal pedestal, which once held the Fresnel lens, is painted dark green, the mandated historic color of the U.S. Lighthouse Service. The brass ventilator caps, which are present around the wainscot, are painted brown with the brass fittings left unfinished.

The door opening leading onto the exterior deck has an inner and an outer door. The 1995 physical investigation revealed that the inner door is a double-leaf, and each leaf has a three-panel wood configuration. The door appears to have been recently painted and there is a wood knob at the interior, however, the exterior hardware is missing. The outer door is a 1/4" thick metal door which is painted black, and is likely a replacement, because the 1909 *Description of Buildings, Premises, Equipment, Etc., at Au Sable Light-Station* states that the outer door at that time was a single-fold wood panel door.

Architectural Barriers

There are several architectural barriers which limit handicapped accessibility at the tower. The ground floor can be accessed without a step from the interior of the Double Keepers' Duplex Residence (HS-11), however, due to the location of the stair, there is an insufficient clearance for mobility once inside.

Double Keepers' Duplex Residence (HS-11)

The following analysis of existing conditions at the Double Keepers' Duplex Residence (HS-11) is based upon both the physical investigation undertaken by Mark Chavez in 1988 (prior to restoration treatments undertaken by the National Park Service from 1988 through 1990), and the physical investigation undertaken by Quinn Evans/Architects in 1995.

Systems Analysis

Structural Framing

Foundation: The foundation walls of the 1874 structure are comprised of a combination of limestone and sandstone, approximately 20" in thickness. The rubble stone foundation walls at the crawl space (1909 addition) are approximately 16" in thickness.

First Floor Framing: There is an 8" x 12" heavy timber beam, which spans east-west at approximately the north-south midpoint of the crawl space. This beam bears approximately 4" into the chimney at its west end and bears onto a concrete pier constructed alongside the brick wall at its east end. In addition, there is an 8" masonry wall, which also spans east-west, is near the south end of the crawl space, and encloses the stair leading up to the first floor. Above this crawl space, the first floor joists are 2" x 10" spaced 16" on center, which span between the beam and the north wall, and between the beam and the concrete block wall.

There is one interior brick wall in the basement, which is 8" thick and runs east-west the full width of the basement at approximately the north-south midpoint of the space. The wall has a 2" x 8" top plate which butts up against the underside of the first floor joists. The first floor joists appear to span the full width of the structure (25' - 6"), bearing on the north and south exterior masonry walls. These joists, and the wood window headers, are mortised and tenoned into the perimeter wood sill plates. The wall bisecting the length of the basement provides center bearing for the continuous wood joists, making the maximum clear span 12' - 6 1/4." Additionally, there is cross-bridging at approximately mid-span, both north and south of the center masonry wall. The 1995 physical investigation revealed holes, approximately 5" x 14" in several of the joists, indicating the previous location of mechanical ducts.

Second Floor Structure: The second floor structure consists of 2" x 10" wood joists spaced 16" on center. These joists, which are 26' - 5" in length, span the entire width of the structure from north to south and bear on the exterior walls, with additional bearing support provided by the interior walls.

Attic Structure: The attic floor framing of the 1874 structure consists of 2 1/4" x 7 1/2" wood joists spaced 16" on center which span north-south the entire width of the structure. The roof structure is comprised of 3" x 6" wood rafter joists spaced approximately 16" on center, which meet at a 2" x 7" wood ridge board, and are tied with 1" x 9 1/2" collar beams which are spaced 32" on center. The collar ties are approximately 6' - 10 1/2" above the attic floor joists.

The attic floor structure in the 1909 addition is comprised of 2" x 7 1/2" joists spaced 16" on center. The roof structure is comprised of 1 3/4" x 6" rafter joists, which are spaced 16" on center, and have 2" x 6" collar beams tying each pair of rafters.

Mechanical

The Double Keepers' Duplex Residence (HS-11) was originally heated by wood burning stoves. The locations of these stoves are indicated by the faint outlines of the former stovepipe openings (thimbles) on each of the chimney faces. These openings were infilled and plastered over in 1950, following the installation of central heating. The heating system consisted of a gravity-type coal furnace located in the basement, and an air distribution system which provided heat to all of the rooms in the dwelling. This heating system was in use until the Coast Guard abandoned the complex in 1958. The National Park Service removed all elements of the heating system, including the furnace and all of the air distribution components in 1989, as part of its restoration treatment to return the dwelling to its 1909 - 1910 appearance.

Electrical

All components of the electrical system, which were installed in 1944, were removed by the National Park Service in 1989 as part of its restoration treatment to return the dwelling to its 1909 - 1910 appearance.

Exterior Fabric Analysis

Roof

The roof of the Double Keepers' Duplex Residence (HS-11) is covered with the same stamped sheet metal shingles, which have a raised decorative pattern, as the roof at the Keeper's Dwelling (HS-09). They are also painted the same color red, however, it was observed during the 1995 physical investigation that there is much more failure caused by paint buildup at this structure, than at the Keeper's Dwelling (HS-09), including excessive oxidation in several areas. Mark Chavez states that,

> In 1977, the existing metal roofing was wire-brushed, patched where necessary, and primed to arrest the rusting that had occurred since the roof's last maintenance under Coast Guard administration, [prior to 1958]. Replacement shingles [which were] to be installed in place of totally deteriorated units were taken from the enclosed east hip in the attic of the two story addition. The missing ridge cap was reproduced locally and installed by park maintenance staff.[6]

National Park Service records also indicate that the roof was painted again in 1981 and in 1984.

Although the roof shingles were painted a third time in 1989 by the National Park Service, the paint has worn off most of the top shingle courses near the ridge pole along the south slope of the roof, and, consequently, the metal has rusted in several areas. The flashing at the south side of the chimney also shows signs of deterioration and water damage. There are a few areas in which replacement shingles, either unfinished or finished with a distinctly different color of red paint, were installed in 1988 to patch former vent stack openings or areas where shingles had deteriorated. These include an area near the east end of the north slope of the roof where the kitchen sink vent stack was located, and an area on the south roof slope where the bathroom vent stack had been located. There is a significant amount of paint failure at the surface of the shingles surrounding the replacement shingles, which appears to the result of water infiltration below and between the shingles, due to an improper connection between the new and old shingles. Furthermore, there is evidence of water infiltration at all of these areas on the interior of the building, as described in the existing conditions analysis of those interior spaces. The 1995 physical investigation also revealed a "ripple" in the shingles coming down from the chimney along the north elevation. The shingles appear to have pulled up from the sheathing, but no failure was observed at the paint surface.

Foundation

National Park Service maintenance records indicate that the 1874 foundation walls were tuckpointed in 1984. Although some of the repointed areas are conspicuously incompatible in mortar color, physical investigation revealed that most of these areas are currently sound.

Walls

The exterior walls are comprised of a soft red brick laid in common bond with five stretcher courses between each header course. The wall system is comprised of two outer brick wythes, (8" thick), a 3" airspace, and an inner brick wythe, (4" thick), creating a total wall thickness of 15".

National Park Service maintenance records indicate that all of the exterior wood surfaces, including the frieze, the door and window openings, and the east porch, were painted in 1978 and, again, in 1989.

Windows

In 1981, the National Park Service boarded up all of the windows and doors with plywood shutters for security

Figure 102

View looking southeast toward the intersection of the Double Keepers' Duplex Residence (HS-11) and the attached passageway, 1988.

reasons, and to protect the building's historic fabric, as shown in **Figure 102**. Later, the National Park Service repaired and refinished the windows as part of its 1988 - 1989 restoration work, which was documented by John Ochman. He states that:

> In the fall of 1988, all windows and doors were removed from HS-11 and were placed in the Grand Marais maintenance shop for repairs during the 1988 - 89 winter and spring months. Prior to restoring the doors and windows, they were labeled and a paint sample taken [from each] for analysis. Paint was removed from the wood surface with the use of an electric heat gun and /or chemical stripper. After removing the paint, numerous window sashes and door members, such as mortise and tenon joints, were repaired. Care was taken to keep as much of the original fabric intact as possible.[7]

All of the plywood shutters were subsequently removed from the openings, and the restored windows and doors replaced in the structure in June of 1990.

Specific East Elevation Conditions

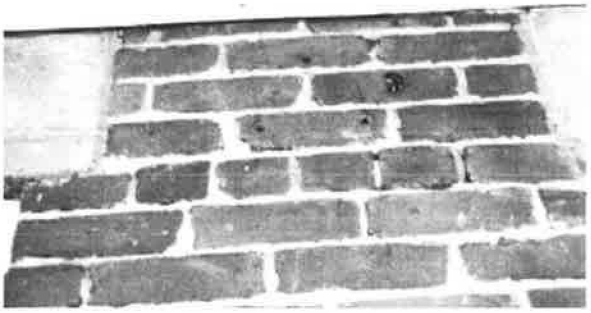
Mark Chavez observed evidence of a former object, possibly a plaque, on the east elevation of the Double Keepers' Duplex Residence (HS-11) and shown in **Figure 103**, stating that:

> A curious but thus far indiscernible outline was discovered on the east elevation (under the porch roof) on the brick wall between the southern door [Door 112.A] and middle window [Window 1-2]. The outline is bell-shaped with three anchor holes (with lead anchors) drilled in the brick. To the upper right is a curled section of heavy wire.[8]

An historic photo of 1950 (**Figure 104**) reveals a round object near the same location, which is painted white. It is not known whether this is the bell-shaped object to which Chavez refers, or if it is some other object.

According to National Park Service maintenance records, the wood porch columns and the main porch beam were replaced in 1976, the stamped sheet metal shingles were removed, and asphalt shingles were installed on the porch roof. However, restoration work in 1988 again required the replacement of the beam, and some deteriorated wood at the columns. The following year (1989), the 1938 concrete porch and foundation were removed by the National Park Service, and a wood porch constructed in its place, which duplicated the historic wood porch of 1909. New

Figure 103



Detail view of the brick surface on the east elevation of the Double Keepers' Duplex Residence (IIS-11). Note the nail holes and staining indicating the former presence of a bell-shaped plaque or other object.

Figure 104

View looking west toward the Double Keepers' Duplex Residence (HS-11), the Tower (HS-10), and the Keeper's Dwelling (HS-09), 1950.

Figure 105

View of a tuckpointed area of brick below Window 1-5 of the Double Keepers' Duplex Residence (HS-11), 1995.

pressed metal shingles were also installed in 1989, and the missing built-in gutter reconstructed.

The 1995 physical investigation revealed that the existing porch deck consists of 3 1/2" wide tongue-and-groove boards laid in an east-west direction. It was also observed that, due to buildup, the paint has failed and the wood has begun to split at the southeast wood column.

Specific South Elevation Conditions

Several of the mortar joints below Window 1-3 are deteriorated, and areas of spalling brick are visible. These conditions have allowed extensive water infiltration through the wall, resulting in plaster deterioration at the interior of the building.

Specific North Elevation Conditions

The basement window at the west end of the north elevation (Window B-1) is boarded up, and the casement is missing. This opening formerly held the coal chute, which was removed in 1989, in conjunction with the removal of the coal room in the basement, by the National Park Service. In addition, conspicuous tuckpointing, due to incompatible mortar color and size, is evident beneath Window 1-11, as seen in **Figure 105**.

Interior Fabric Analysis

General Observations

The following general observations were stated by Mark Chavez based on his physical investigation of the structure during the summer of 1988 (prior to any restoration treatments by the National Park Service):

> The bulk of the damage [deterioration of interior fabric] was concentrated in the upper quarters of the kitchen, primarily at the northeast corner. Park records indicate roof repairs in this area in the late 1970s correcting damage which caused the deterioration. Plaster surfaces on the exterior wall and ceiling were also quite deteriorated. The other rooms on the lake side were showing signs of distressed plaster surfaces and peeling paint due primarily to winter moisture intrusion through temporary wood window shutters. Generally damage was limited to these areas. Peeling paint was common, but this effect would be expected due to the nature of the building's lack of interior protection during winter months. The structure survived remarkably well over the years, however. Limited moisture intrusion was noticed in the basement, and wood members were in very good condition.[9]

Chavez's analysis is especially important in that the conditions and problems which he observed, were removed and /or resolved by the National Park Service during the agency's restoration treatments at the structure from 1988 through 1990. Several of the conditions that Quinn Evans/Architects observed, therefore, were the end results of the Park Service's restoration treatments.

Room Designation

According to Mark Chavez, "Room numbers relate to the numbering assigned for existing room layout. Room names are from the 10/25/50 U.S. Coast Guard drawings for the 'Alterations to Dwelling Sanitary Facilities,' the floor plan which most closely resembled the existing conditions as found in 1988 - 1989."[10] For simplicity, these numbers are used in this report, however, as a result of significant alterations in 1989 to return the interior layout to its 1909 appearance, some of the room names have changed and some rooms noted by Chavez, (which were later additions to the dwelling), no longer exist.

Basement Conditions

Floor: The floor is painted concrete, and the 1995 physical investigation revealed no apparent signs of deterioration.

Ceiling: The basement does not have a finished ceiling, thus, the first floor structure is exposed. The underside of the structure, including the bottom of the subfloor and the sides of the joists are whitewashed.

Walls: The rough faced stone walls are whitewashed, and although this is a historic finish, a new layer of whitewash was applied to both the walls and the ceiling in 1989 by the National Park Service. Further, Door B.02 is missing at the brick wall.

Conditions at the First and Second Floors

Floor: The finish floor throughout the 1874 structure, at both the first and the second floors, is comprised of 5 1/2" wide tongue-and-groove boards which are 7/8" thick and are laid in an east-west direction. The 1995 physical investigation revealed that the flooring runs continuously through all of the door openings, and that there are no thresholds between the rooms. The finish floor throughout the 1909 addition at both the first and second floors, consists of 2 1/4" wide tongue-and-groove boards which run north-south. As at the 1874 portion of the dwelling, the floor boards run continuously through the door openings, and there are no thresholds between the rooms.

Walls: Physical investigation by Mark Chavez in 1988 revealed that wood grounds were strategically located within the inner brick wythe of the exterior walls, onto which wood furring strips (and wood lath) are attached. Chavez revealed that at the interior walls of the structure, the plaster is attached to plasterboard lath.

First Floor

Room 101, Entry

Walls: The 1988 physical investigation revealed that the plaster was extensively deteriorated at the exterior walls, especially at the northeast corner of the room, as seen in **Figure 106**. Although the plaster was replaced and refinished by the National Park Service in 1989 - 1990, the 1995 physical investigation revealed that water infiltration has continued, resulting in extensive cracking and spalling of the new plaster surface at the northeast corner of the room, especially near the ceiling.

This room, and the damaged plaster in it, is below an area of roof repaired in 1988 but still showing signs of water infiltration between the old and new shingles, as discussed above. Furthermore, Room 201, directly above Room 101, also underwent extensive plaster repair in 1989-1990 due to roof leaks, yet also continues to show deteriorated plaster. Therefore, the likely cause of the plaster deterioration in both rooms is primarily water infiltration through the improperly patched roof and secondarily water vapor infiltration through the exterior walls. The wall cavity would provide an excellent route for the water moving from the roof to the lower room. Significantly, the plaster damage is concentrated at the upper north wall and ceiling. Surface condensation may be a contributing factor, but would be more evenly distributed over the rooms' exterior walls.

Figure 106

View looking northeast in the entry vestibule (Room 101) at the deteriorated wall and ceiling plaster prior to restoration, 1990.

Ceiling: The 1988 physical investigation revealed that the ceiling plaster had also experienced excessive deterioration. This plaster was repaired and refinished in 1989 - 1990. However, due to continued water infiltration, as discussed above, there is some deterioration of the new plaster surface, especially in the northeast corner of the room.

Room 102, Living Room

Walls: The 1988 physical investigation revealed the ghosted image of a 1 1/4" wide picture molding in the surface paint, 16 1/2" below the ceiling (which is the same height as the window heads). Although the picture molding was not reconstructed as part of the restoration treatments by the National Park Service, the new paint color changes at this height, which is a typi-

cal paint scheme used in conjunction with a picture molding.

Ceiling: Extensive cracking was observed in the ceiling plaster during the 1988 physical investigation, which was later restored by the National Park Service. No signs of deterioration were observed in 1995.

Room 103, Bedroom

Floor: The floor surface was covered with several layers of paint during the 1988 physical investigation. The 1995 physical investigation revealed that it had been recently repainted, however, it appears not to have been scraped prior to its repainting, as areas of paint buildup are still present.

Walls: During the 1988 physical investigation, the exterior walls were missing entire sections of plaster, exposing the brick surfaces beneath, to which the plaster had been directly attached. Only minor damage was observed at the interior walls. The plaster was replaced and restored in 1989 - 1990, and no apparent signs of deterioration were observed during the 1995 physical observation.

The 1988 physical investigation also revealed a demarcation in the wall paint, approximately 7'-6" above the floor, indicating the previous location of a picture molding. Additionally, the investigation revealed a door at the south wall, which was level with the stair landing on the other side of the wall, therefore, approximately 8" higher than floor level in this room and had a step built up to it. This being a non-period door opening (constructed in 1950), it was removed by the National Park Service, and the wall restored to its 1909 appearance.

Ceiling: The 1988 physical investigation revealed a severely deteriorated ceiling, with several areas of plaster missing, thereby exposing the second floor framing. This plaster was restored in 1989 - 1990 and, with the exception of surface hairline cracking, no signs of damage or deterioration were observed during the 1995 physical investigation.

Room 104, Closet

A few non-period alterations were observed in this closet by Mark Chavez in 1988, including a non-period baseboard and a flat header, which dropped in the doorway. Presumably this header was constructed due to the low, uneven head height beyond, which is the stair run. Both of these alterations remained, with new finishes applied, during the 1995 physical investigation.

Room 105, Stair Hall

Walls: Minor plaster deterioration was observed by Chavez during his 1988 physical investigation. These areas were restored by the National Park Service, and no damage or deterioration was observed in 1995. Chavez also observed a post-1910 change to the hall, which was the door opening into the adjacent Oil Room, Room 107. The later door, however, was removed and the wall restored to its 1909 appearance. Through destructive investigation, Mark Chavez located the original door opening into Room 107, which was then reconstructed in 1989 - 1990.

Ceiling: The ceiling, which is actually at the second floor, was extensively deteriorated in 1988. However, it was restored by the National Park Service in 1989 - 1990. There were no apparent signs of new or additional deterioration observed during the 1995 physical investigation.

Stair: During his 1988 physical investigation, Chavez noted that the stair was severely damaged. The newel post, several balusters, and most of the handrail were missing. He also observed that the stair run itself had also been changed sometime after 1950. The entire stair was restored, and several of the missing elements reconstructed, in 1988. In addition, the bottom steps were reconstructed to resemble their original configuration, and the non-period door opening into Room 103 was removed.

Room 106, Closet

In 1988, it was observed that the walls were coated with several layers of whitewash, a finish typically used in storage and other secondary spaces. The 1995 physical investigation revealed the same finish and, with the exception of minor hairline cracking, no apparent signs of deterioration.

Room 107, Oil Room (Bathroom 1939 - 1989)

At the time of the 1988 physical investigation this room was a bathroom, however, all of the bathroom fixtures and plumbing were removed in 1989, and the space restored to its 1909 appearance by the National Park Service.

Floor: The floor was covered with linoleum during the 1988 physical investigation. This linoleum was removed, and the hardwood floor beneath restored and refinished by the National Park Service. No signs of damage were apparent in 1995.

Walls: Destructive investigations conducted in 1989 revealed evidence of a wood wainscot here, which had been removed, and a baseboard installed as part of the bathroom renovation in 1939. The original door opening was also revealed, which had been infilled to accommodate the location of a bathtub, and a new opening, east of the original one, had been constructed. Observation of an identical oil room at the Outer Island keeper's dwelling (also on Lake Superior) revealed an identical wood wainscot. In 1989, the National Park Service infilled the non-period door opening and reconstructed the historic opening in its original location. All of the bathroom fixtures and the non-period baseboard were also removed. Furthermore, the historic beaded board wainscot was reconstructed based on that which was observed at Outer Island.

Ceiling: Areas of plaster were extensively deteriorated at the time of the 1988 physical observation. This plaster was restored and, with the exception of a few hairline surface cracks, no deterioration was observed in 1995.

Room 108, Dining Room (Original Kitchen)

Floor: The painted wood floor was observed as warped and buckled in several areas during the 1988 physical investigation. National Park Service maintenance records indicate that these areas of damage were repaired in 1989 - 1990. The 1995 physical investigation revealed that the floor had also been repainted, however, it appeared not to have been scraped, as areas of paint buildup are still present.

Walls: Plaster deterioration was observed at the walls during the 1988 physical investigation. The plaster was restored by the National Park Service in 1989 - 1990, and no deterioration was observed in 1995.

Ceiling: At the time of the 1988 investigation, the paint was peeling and several areas of the ceiling plaster were either cracked or deteriorated. The plaster was restored in 1989 - 1990, and no apparent signs of deterioration were observed during the 1995 physical investigation.

Room 109, Closet (Original Pantry)

The walls are lined with a 3' - 0" tall wood wainscot, which is painted white and is presumed to be part of the original 1874 construction, as this was the dwelling's original pantry. No apparent signs of damage or deterioration were observed at the plaster or wood surfaces in the closet during the 1995 physical investigation.

Room 110, Kitchen

Floor: The floor appears to have only a few layers of stain and relatively no signs of damage, presumably attributable to the presence of a heavy linoleum covering the wood for several years. The linoleum was removed and the wood floor refinished by the National Park Service in 1989, however, the ghosted demarcation in the floor boards indicating the perimeter of the linoleum was still visible during the 1995 physical investigation. Additionally, the 1995 investigation revealed that an area of the floor boards near the northeast corner of the room had been patched at the location of the original kitchen sink.

Walls: Physical investigation in 1988 revealed that most of the plaster at the exterior walls had deteriorated, with several large sections completely missing. The plaster surfaces were restored in 1989 - 1990, and no apparent signs of new or additional deterioration were observed in 1995.

Ceiling: The ceiling was also extensively deteriorated in 1988, however, it was restored in 1989 - 1990. No apparent deterioration was observed during the 1995 physical investigation.

Room 111, Pantry

Mark Chavez reported that there were no unique conditions in this closet, and the 1995 physical investigation revealed only hairline plaster cracks.

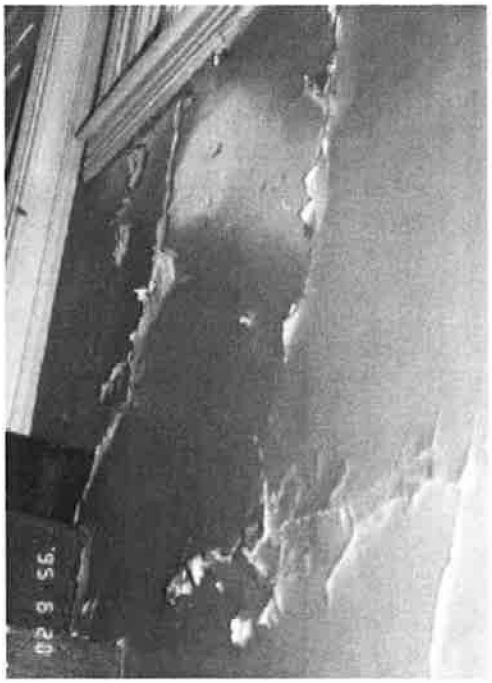
Room 112, Entry Vestibule and Stair to Basement

Walls: The 1988 physical investigation revealed extensive plaster deterioration at the south wall, as seen in **Figure 107**. Although this plaster was restored in 1989 -1990, the 1995 physical investigation revealed extensive plaster cracking and spalling of the refinished surface, especially beneath the stool of Window 1-3, indicating continued water infiltration, as seen in **Figure 108**. Physical investigation at the exterior face of the wall revealed deteriorated mortar joints beneath the window sill, indicating the cause of the water infiltra-

Figure 107

View at the south stair (Room 112), looking down into the basement of the Double Keepers' Duplex Residence (HS-11), 1990. Note the deteriorated plaster below Window 1-3.

Figure 108



View of the spalling and cracking plaster beneath Window 1-3, Room 112, of the Double Keepers' Duplex Residence (HS-11), 1995.

tion. As discussed previously, the air space in a cavity wall provides only a limited amount of water protection. When exterior mortar joints are deteriorated and open, rain water can be blown or wicked directly into the cavity space, wetting the inner wythe of brick. Water vapor also condenses on the inner wythe. The water then moves easily through the permeable brick and finish plaster, resulting in the type of damage shown.

Second Floor

Room 201, Kitchen

Floor: Extensive paint buildup was observed on the floor surface in 1988. The floor was then stripped and a clear finish applied by the National Park Service in 1989-1990. However, the 1995 physical investigation revealed a faint rectangular demarcation at the perimeter of the room, denoting the previous location of a floor covering. The investigation also revealed that an area of floor boards at the northeast corner of the room had been patched, presumably because the original boards had rotted from water leakage from the original sink which was located here.

Walls: The 1988 physical investigation revealed excessive plaster deterioration at the exterior walls, especially at the north wall. Although the plaster was restored by the National Park Service in 1989 - 1990, the 1995 physical investigation revealed spalling and cracking of the restored plaster at the north wall, indicating continued water infiltration. Further investigation revealed that the opening from the former kitchen vent stack, cut in the roof sheathing directly above the area of deterioration, was improperly patched, and thus, in addition to possible mortar failure at the brick wall surface, this area may be the main source of the water infiltration.

Ceiling: Following his 1988 physical investigation, Mark Chavez noted plaster deterioration at the northeast corner of the ceiling. Although the plaster surface was restored in 1989 -1990, the 1995 physical investigation revealed additional deterioration, which appears to also be the result of the previously mentioned vent stack opening directly above.

Room 202, Closet (Pantry)

This space was formerly the kitchen pantry for the second floor residence. Although the door is missing from the opening (Door 201.B), no apparent signs of dete-

rioration were observed during the 1995 physical investigation.

Room 203, Bedroom

Floor: During the 1988 physical investigation, a rectangular demarcation in the paint surface revealed the location of a former floor covering. The surface was restored by the National Park Service in 1989 -1990, rendering the demarcation indiscernible in 1995.

Walls: The 1988 physical investigation revealed the ghosted profile of a 1 1/4" picture molding in the paint surface, approximately 7' - 6" above the floor. Although this was not reconstructed by the National Park Service, the 1995 physical investigation revealed that the paint color changed at the previous location of the molding, which is a typical paint scheme (changing color at the picture molding) of the 1909 - 1910 period.

Ceiling: Minor plaster deterioration was observed in 1988, however, the plaster was restored by the National Park Service in 1989 - 1990. No new or additional signs of deterioration were observed in 1995.

Room 204, Closet

Mark Chavez noted from his 1988 physical investigation that this was the only closet within the Double Keepers' Duplex Residence (HS-11) in which all of the original coat hooks were intact.

Room 205, Bedroom

Floor: The 1988 physical investigation revealed extensive paint buildup at the floor surface. The floor was stripped and a stain finish applied by the National Park Service in 1989 - 1990. Although no apparent deterioration was observed, the 1995 physical investigation revealed several butt joints in the floor boards in front of the closet at the southeast corner of the room, indicating that the floor boards were patched.

Walls: The 1988 physical investigation revealed several plaster cracks, however, the entire plaster surface was restored in 1989 - 1990.

Ceiling: Several cracks and areas of missing plaster were observed during the 1988 physical investigation, all of which were repaired, and the entire ceiling surface restored in 1989 -1990. No signs of deterioration were observed in 1995.

Room 206, Closet

Floor: According to Mark Chavez, prior to the 1988 physical investigation, the floor had been "disturbed," presumably during the installation of electricity or the air distribution system. No signs of damage were observed during the 1995 physical investigation, however.

Walls: Mark Chavez's 1988 physical investigation revealed that the original baseboard had been removed, and a non-period baseboard installed in its place. No signs of plaster damage or deterioration were observed during the 1995 physical investigation.

Room 207, Hall (No longer exists)

Following his 1988 physical investigation, Mark Chavez stated,

> When the building was modified [in 1939] for the two bathrooms [one at each floor], the doorway into Room 209 was moved east and a vestibule [Room 207] into the bathroom created. The closet to the former bedroom in this corner of the building (a mirror image of the bedroom on the opposite side of the hallway) was removed to accommodate this change. ...the doorway into the historic bedroom was located directly opposite the doorway into Room 205. The west wall of the historic closet was removed and a new wall extension added to meet the new east bathroom wall [1]

The non-period walls were removed and the spaces restored to their 1909 appearance by the National Park Service in 1989 - 1990, thus, eliminating Room 107. No evidence of Room 107 was evident during the 1995 physical investigation.

Room 208, Stair Hall

Floor: In 1988, there was an excessive amount of paint buildup on the floor. The 1995 physical investigation revealed that the floor had been recently repainted, and there were no apparent signs of deterioration.

Walls: There is a wood ship's ladder recessed into the north wall which leads up to the attic. The 1995 physical investigation revealed that the steps consist of 2 1/2" x 1" beaded boards, and the entire recess, as well as the steps, are painted white. Furthermore, no apparent signs of damage or plaster deterioration were observed in 1995.

Ceiling: The ceiling was badly deteriorated, with several areas of plaster missing, during the 1988 physical investigation. The entire ceiling was patched and repaired prior to the 1995 physical investigation.

Room 209, Bedroom, (Bathroom 1939 - 1989)

Floor: During the 1988 physical investigation, this room was still a bathroom with the floor covered with linoleum. All of the bathroom fixtures and subsequent non-period finishes were removed by the National Park Service in 1989 - 1990. No evidence of the bathroom was observed in 1995.

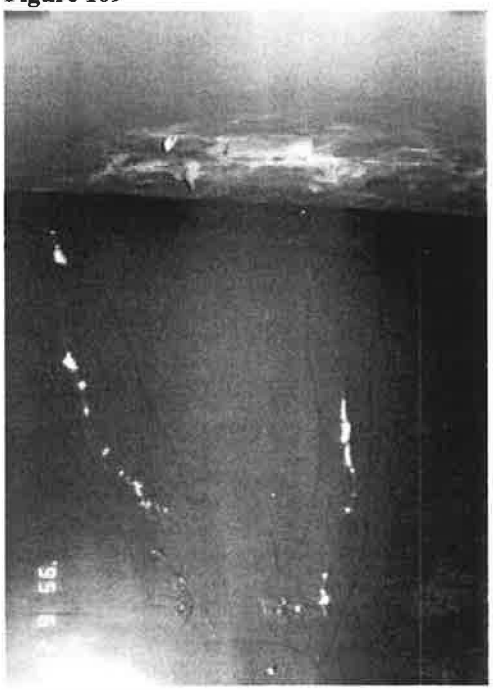
Walls: The wall, mentioned in Room 208, constructed to divide the southwest bedroom, Room 209, into a bathroom, small hall space, and a large closet for Room 210, was removed, and the bedroom (Room 209) restored to its 1909 appearance by the National Park Service in 1989 - 1990. Additionally, the non-period baseboard that was installed as part of the bathroom alterations was also removed, and a historic reproduction of the original baseboard installed in its place.

Plaster deterioration was observed at the exterior walls during the 1988 physical investigation. Although the plaster surfaces were restored by the National Park Service in 1989 -1 990, the 1995 physical investigation revealed additional cracking and spalling of the restored plaster surface of the south wall near the previous location of the non-period wall, as seen in **Figure 109**. Further investigation revealed that the plumbing vent stack once penetrated the roof directly above this location. The roof sheathing was not properly repaired following the removal of the vent stack, thus allowing water infiltration, and damage of the restored plaster surface.

Ceiling: The 1988 physical investigation revealed extensive plaster deterioration at the ceiling. Although, the entire surface was restored by the National Park Service in 1989 -1990, the 1995 physical investigation revealed peeling paint and spalling and cracking plaster directly below the previous location of the plumbing vent stack, as seen in Figure 109. As with the deterioration observed at the south wall surface, this appears to be caused by water infiltration at the improperly sealed opening in the roof sheathing.

Room 210, Living Room

Figure 109



View of the deteriorated plaster at the south wall and the ceiling of the southwest bedroom (Room 209), 1995.

Floor: Several layers of paint buildup were observed on the floor during the 1988 physical investigation. The 1995 physical investigation revealed that the surface had been recently repainted, however, some paint buildup is still evident.

Walls: Peeling paint and some minor plaster deterioration and cracking at the wall surfaces were observed in 1988. All of the plaster was restored in 1989 -1990, and no apparent signs of further deterioration were observed in 1995.

Ceiling: Peeling paint and some minor plaster deterioration and cracking were observed in 1988. Although all of the plaster surfaces were restored in 1989 - 1990 by the National Park Service, minor hairline cracks were observed during the 1995 physical investigation.

Room 211, Closet

With the exception of some minor hairline surface cracks, there were no apparent signs of plaster damage during the 1995 physical investigation.

Room 212, Closet

With the exception of some minor hairline surface cracks, there were no apparent signs of plaster damage during the 1995 physical investigation.

Room 213, Dining Room

Floor: The 1995 physical investigation revealed that the floor boards have been stripped and a clear finish applied by the National Park Service. Additionally, the investigation revealed that an area of the floor boards had been replaced near Door 210.D.

Walls: The 1988 physical investigation had revealed deteriorated plaster at the exterior walls. All of the plaster surfaces were then restored by the National Park Service in 1989 - 1990. However, the 1995 physical investigation revealed additional spalling and cracking of the restored plaster, which extends the entire height of the east wall near the northeast corner of the room, indicative of water infiltration.

Attached Passageway

The tower (HS-10) is connected to the Double Keepers' Duplex Residence (HS-11) by an attached brick passageway. As the passageway is part of the original design, most of its construction details and materials are identical to those found at the Double Keepers' Duplex Residence (HS-11).

Exterior Fabric Analysis

Roof

The roof of the passageway between the Double Keepers' Duplex Residence (HS-11) and the tower (HS-10) has stamped metal shingles identical to those on the roofs of both of the dwellings. There are several areas of paint buildup, especially near the west end of the roof, and several of the shingles are pulling loose from the roof substrate in the same area. The paint on the sheet metal flashing, located at the connection where the roof meets the tower wall, and where the roof meets the west elevation of the Double Keepers' Duplex Residence (HS-11), has extensively failed, showing extensive bubbling beneath the surface. Additionally, the 1995 physical investigation revealed that one area of the roof, just north of the ridge pole, was patched with sheet metal, which was painted red to match to match the adjacent shingles.

Walls

Physical observation revealed a vertical strip of white paint on the brick surface on each side of the covered passageway, near the east end toward the Double Keepers' Duplex Residence (HS-11). This location corresponds with that of the former 8" concrete block wall constructed on the interior, and since demolished. The wide joint at the intersection of the tower wall and the passageway is filled with a sealant painted gray. All of the exterior wood trim, including the frieze board, cove molding, and fascia, are painted white, as at the Double Keepers' Duplex Residence (HS-11).

Foundation

Above grade, the foundation of the passageway consists of dressed limestone and sandstone blocks, approximately 6 1/2" in height by 11" in length, similar to those at the attached Double Keepers' Duplex Residence (HS-11), constructed at the same time. The face of the foundation wall slightly protrudes from the face of the brick wall above, and the top of the foundation is covered with a mortar wash. There is a small metal ventilation grille three stone courses below the top of the foundation, and midway between the tower (HS-10) and the Double Keepers' Duplex Residence (HS-11), at both the north and the south elevations. Presumably these grilles ventilate the inaccessible space beneath the floor of the passageway. This ventilation detail can also be seen at other masonry passageways of Great Lakes lighthouses, such as the one at the South Manitou Island Light Station on Lake Michigan.

Below grade, the foundation wall was not as uniform, as evidenced by Bruce Jones during his 1990 excavation alongside it. Jones states that,

> Below grade, the masonry wall of the connecting passageway consisted of larger and more irregularly shaped blocks of sandstone and limestone. These extended unbroken upward from the lowest course, which has been constructed of even more massive and irregular stone and mortar laid in a narrow trench excavated directly into the sand.[12]

This part of the foundation is covered with parging which, during the 1995 physical investigation, was visible approximately 8" - 10" above grade. In addition, a lichen was visible on the stone surface of the south foundation wall.

Interior Fabric Analysis

Walls

During the 1988 physical investigation, the concrete block wall, constructed by the Coast Guard in 1960, was still in place, however, it was later removed by the National Park Service in 1988. The deteriorated plaster within the space was also restored by the Park Service in 1988, although a portion of the plaster at the east wall, above Door P-01, was not replaced, thus revealing half of the structural brick arch which supports the opening. This arched head construction detail existed at all of the exterior openings prior to 1909. **Figure 110** shows the portion of missing plaster, indicating that the arched head of the opening is much higher than the actual finished door opening.

Figure 110

View of the east wall in the Passageway, 1995. Note the area where the plaster is missing above the door, which shows that the opening is supported by an arch which is much higher than the actual door opening.

Floor

The floor consists of 5 1/2" wide, tongue-and-groove boards, which are painted and laid in an east-west direction, and are the same as those at the first floor of the attached Double Keepers' Duplex Residence (HS-11).

Openings

The 1995 physical investigation revealed that the five-panel exterior door leading into the passageway had been restored, and no paint buildup was observed. However, as at all of the exterior doors of the Keeper's Dwelling (HS-09) and the Double Keepers' Duplex Residence (HS-11), non-period brass hardware has been installed by the National Park Service, as seen in **Figure 111**. Additionally, demarcations of the former (possibly original) hardware were observed on the door. The sill of the door opening is approximately 2' - 6" above grade at the exterior and is reached by a concrete stair which is covered with several coats of gray paint.

Figure 111

Detail view of the typical non-period hardware installed by the National Park Service at the exterior doors of both the Keeper's Dwelling (HS-09) and the Double Keepers' Duplex Residence (HS-11), 1995.

The double casement window on the north wall, during the 1995 physical investigation, had inappropriate non-period brass hinges.

Fog Signal Building (HS-16)

Exterior Fabric Analysis

The walls of the Fog Signal Building (HS-16) are common red brick laid in stretcher bond. The bottom three brick courses protrude approximately 1" from the brick wall face, creating a plinth around the entire perimeter of the structure. The 1995 physical investigation revealed several areas of incompatible mortar color and

joint size, evidence of the tuckpointing undertaken in 1984 by the National Park Service.

The current black asphalt shingles were installed in 1976 by the National Park Service as part of the emergency stabilization efforts undertaken throughout the lighthouse complex. However, Enviroscience, Inc. found the historic shingles during their 1990 physical investigation, stating that, "Samples of both types of shingles are stockpiled in the [fog signal] building. The wood shingles are 10 1/2" by 16" with 5 1/4" exposed to the weather and have traces of red paint; the shingles are stamped on the back side with an unidentified lumber yard on Port Angeles, Washington. The metal shingles are 18" x 27" and have a pattern similar to the shingles on Privy #2 (HS-15)."[13]

The chimney is red brick laid in common bond with a header course between every seven stretcher courses, and has a rough concrete cap which does not appear to be deteriorated. However, the 1995 physical investigation did reveal that the metal flashing had pulled loose from the brick surface at both the north and south faces of the chimney.

All of the openings at the Fog Signal Building (HS-16) have segmented brick arches at the exterior which, with the exception of some minor cracking in the mortar joints, show no signs of deterioration. Additionally, the top of the door sills are flush with the top of the brick plinth, which extends around the entire perimeter of the structure; a typical feature found at all of the brick outbuildings at the Au Sable Light Station.

National Park Service records indicate that the soffits and the exterior wood trim were repaired and painted in 1977. These surfaces were also painted in 1981, 1984, 1987, and, again, in 1990. No apparent signs of deterioration were observed at these surfaces during the 1995 physical investigation.

Specific West Elevation Conditions

Along the entire length of the west elevation, the bottom five to six courses of brick have deteriorated, appearing lighter in color, and with a rougher surface than the bricks at the rest of the structure, as seen in **Figure 112**. The reason for this deterioration is currently not known. Several cast iron pipes protrude from the brick wall near grade, but they have been capped. The two pipes at the south end are the fuel lines which

Figure 112

View of incongruous brick at the west elevation of the Fog Signal Building (HS-16), 1995.

once extended to the underground gasoline tank located south of the building. The pipe at the north end of the wall was a water line. Additionally, there is a metal pipe extending from the brick wall just south of the door opening. Presumably, this capped pipe, approximately 1 1/2" in diameter, is what is left of a piping system through which excess water from the steam boilers was pumped from a cooling tank in the Fog Signal Building to the cisterns in the basements of each of the dwellings.

Specific North Elevation Conditions

The openings in the north face of the dormer, through which the air horns once extended, were covered with sheet metal during the 1995 physical investigation. However, the metal brackets attached to the brick wall that supported the horns were extant.

Specific East Elevation Conditions

The 1995 physical investigation revealed seven tie rods extending out from the brick surface and attached to metal plates, as seen **Figure 113**. These support the interior platform for the air receiving tank which was part of the air diaphone system. Additionally, there is a metal pipe which extends out from the brick wall just north of the window opening that has been capped. Presumably this pipe was a part of the air piping system or was used for returning water from the steam boilers in the Fog Signal Building to the underground brick cistern located just east of the building.

Structural Framing

Figure 113

View of the east elevation of the Fog Signal Building (HS-16), 1995.

The roof structure of the Fog Signal Building (HS-16) is comprised of 2" x 6" rafters which meet at a 2" x 8" ridge board. The roof sheathing is comprised of 1" white pine boards, varying in size, with an average width of approximately 12". The 2" x 6" collar beams which tie these rafters, create an attic space, which has an attached ceiling, within the structure. There is a hatch providing access into the attic space just north of the chimney. The ceiling collar ties are notched at the north end of the structure, which allowed for the installation of the suspended platform.

Interior Fabric Analysis

The interior brick walls of the Fog Signal Building (HS-16) are brick laid in stretcher bond and are painted light gray. The bottom three brick courses are painted a darker gray color, simulating a baseboard trim. The floor is a concrete slab on grade, and is painted the same dark gray as the 'baseboard.' The door and window openings are supported at the interior brick wythe of the walls by jack arches, however, these have failed above both the north and west door openings, as evidenced by the extensive cracking. The ceiling is comprised of a layer of sheathing which is attached to the bottom of the collar ties and are covered with 2' - 0" x 4' - 0" galvanized metal panels. These metal panels are painted the same color as the wall surfaces, and were installed by the Lighthouse Service as fire protection.

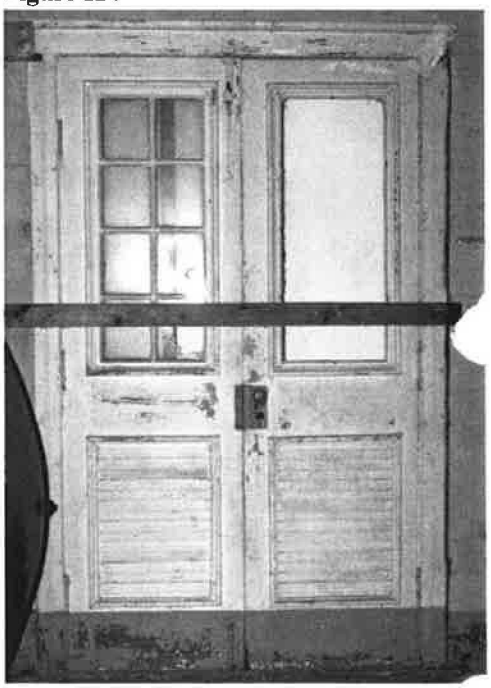
All of the doors in the building are extant, however, they have some missing and /or deteriorated wood members. The opening at the north elevation has two doors, which are each 3'-0" wide and 2' - 8" high, and a four-pane transom spans the entire door opening. These doors each consist of two panels of diagonal boards. The door openings at the east and the west elevations are identical, each having two doors (with no middle divider) that are 2' - 4" wide and 8' - 0" in height. The door configuration is two-panel, the top panel having eight divided lights and the bottom panel comprised of horizontal beaded boards, as seen in **Figure 114**. All of the glass and the muntins are missing from the south door at the east elevation, and several panes of glass are broken in the north door. At the west elevation, there are also several broken panes of glass from both doors.

The windows at the east and west elevations each had six-over-six double-hung wood sashes, but the sashes were removed from the window openings prior to both the 1990 and the 1995 physical investigations. There are two window openings at the south elevation, which have six-light, fixed wood sashes that are painted white. All of the remaining windows have several broken panes of glass, and several areas of wood that have deteriorated.

Metal Oil House (HS-12)

Exterior Fabric Analysis

Figure 114



Interior view of the east doors in the Fog Signal Building (HS-16), 1991.

During the 1995 physical investigation, the exterior walls of the metal oil house (HS-12) were painted bright yellow and the roof red. National Park Service maintenance records indicate that the exterior of the structure was painted in 1977, 1981, 1984, and in 1989, however, it appears that the structure was not painted yellow until 1994. There are splatters of several different paint colors, including: black, white, red, and gray, on the surface of the concrete slab which supports the structure. These splatters suggest that the metal oil house has been several different colors since its 1915 construction. During the 1995 physical investigation, several small areas, none greater than 1/2" in diameter, of rust appeared on the west face of the structure. National Park Service records indicate that the structure was restored in 1977, however, there are no recorded details of what this restoration entailed.

Interior Fabric Analysis

The interior of this structure was not accessible during the 1995 physical investigation. The last maintenance record regarding the interior refers to its painting in 1977 by the National Park Service. Previous physical investigation, by Walter Douglas of the National Park Service in 1978, revealed that the interior walls are lined with brick, assumed to have been installed for fire-protection and to stabilize temperatures within the structure.

Brick Oil House (HS-13)

The walls of the brick oil house (HS-13) are common red brick laid in stretcher bond, and show no outward signs of deterioration. The top brick course around the perimeter of the building is a header course with two stretchers at each of the corners. There is also a header course near grade on the south elevation of the building. The 1995 physical investigation revealed that this header course was flush with the adjacent wall surface at the west end of the structure, however, it extends 1 1/2" from the face of the brick wall at the east end of the elevation.

The 1995 physical investigation also revealed several cracked mortar joints at the bottom of the east corner of the north elevation. Additionally, it was apparent that some areas of the wall surfaces have been tuckpointed, as evidenced by the incompatible color of the replacement mortar with the original. National Park Service records indicate that this tuckpointing was done in 1984.

The wood cornice trim of the structure is painted white and show no signs of deterioration, however, the mitered corners of the cornice were pulling apart during the 1995 physical investigation. The flat seam, hip roof which has standing seams at the four hips, is, according to the *1909 Description of Buildings, Premises, Equipment, Etc. at Au Sable Light-Station* comprised of #22 galvanized iron. Maintenance records indicate that the roof and the exterior wood trim were painted in 1976, 1981, 1984, and again in 1989.

There is a riveted metal door at the north elevation of the building which was welded shut by the National Park Service prior to the 1995 physical investigation. However, an extensive amount of paint buildup was observed on the exterior door surface, as evidenced by the cracking and peeling paint, and the consequently exposed metal which has rusted. The door opening has a smooth-faced stone sill, while the limestone lintel has a rough cut face. Deterioration was not evident at either of the stone surfaces.

Interior Fabric Analysis

Due to the door being welded shut, the interior of this structure was not accessible during either the 1995 physical investigation, or during any of the other physical investigations conducted prior to 1995.

Brick Privy #1 (HS-14)

The privy's walls are red vitrified brick, identical to those at the Keeper's Dwelling (HS-09), and are laid in stretcher bond course, with some decorative header course at the north elevation. Near the bottom of the structure, two courses of brick, approximately 6" above grade, protrude approximately 1" from the face of the wall, creating a plinth around the entire perimeter of the structure. National Park Service records indicate that deteriorated mortar joints were tuckpointed in 1984, and no apparent signs of deterioration at the brick surfaces were observed during the 1995 physical investigation. The door opening is on the north elevation, and was boarded up with plywood and blocked during the 1995 physical investigation. However, a 1973 photograph of the privy (**Figure 115**), before it was boarded up, reveals that at that time the door was a five-panel, horizontal configuration door, similar to those found at the interior of both dwellings. The stone sill of the door opening, which is flush with the brick plinth, was painted gray during the 1995 physical investigation while the stone lintel remained unfinished.

Figure 115

View of the brick Privy (HS-14) south of the Keeper's Dwelling (HS-09), 1973. Note the five-panel wood door which is identical to those in the Keeper's Dwelling (HS-09).

Figure 116

Aerial view from the Tower's platform looking down at the small complex of structures south of the Double Keepers' Duplex Residence (HS-11) which includes a brick Privy (HS-15), the Brick Oil House (HS-13), and the Metal Oil House (HS-12), 1995.

Both the east and the west elevations each have a window with unfinished stone sills and lintels. However, the type of window was indeterminable because both windows were boarded up with plywood during the 1995 physical investigation. Historic photographs indicate that the windows consisted of three divided lights, and presumably had either an awning or hopper operation.

The cornice and eaves of the structure are painted white. Both the pressed metal shingle roof and the central metal vent stack are painted red, and there is no evidence of rust. National Park Service records indicate that all exterior surfaces were painted in 1984. The 1995 physical investigation revealed some areas of wood deterioration at the eaves, and the mitered corners of the cornice are pulling apart, likely due to moisture content and wood shrinkage. Additionally, the 1995 physical investigation revealed that the wood cleanout cover had deteriorated.

Brick Privy #2 (HS-15)

This brick privy is part of a small cluster of three structures south of the Double Keeper's Duplex Residence (HS-11), including the Brick Oil House (HS-13) and the Metal Oil House (HS-12), as seen looking down from the Tower in **Figure 116**. A concrete walk leads from the Double Keepers' Duplex Residence (HS-11) to the entrances of these structures. The walls of the privy (HS-15) are common red brick laid in stretcher bond with one header course near the top of the gable of the west elevation. Near the bottom of the structure, about 10" above grade, there are two brick courses which protrude approximately 1 1/2" from the brick face creating a plinth around the perimeter of the structure. The door opening on the west elevation is supported by a jack arch, and has a stone sill which is flush with the brick plinth. Although the door opening was covered with bolted plywood during **the 1995 physical investigation, a 1973 photograph (Figure 117)** revealed that at that time the wood door consisted of five vertical panels with two horizontal ledgers, a configuration unique to the station. There is one window on the south elevation of the privy which is supported by a jack arch and has a stone sill, as shown in **Figure 118**, neither of which appear deteriorated or damaged.

Both the pressed metal shingle roof and the wood trim were painted by the National Park Service in 1976 and 1984. In addition, areas of deteriorated mortar were tuckpointed in 1984. The 1995 physical investigation revealed that the wood cornice trim and the wood vent both show significant signs of deterioration. Further, a portion of the wood cornice has completely deteriorated and fallen off of the structure at the west end of the north elevation, as seen in **Figure 119**. The metal ridge pole at the roof ridge appears relatively new and in good condition. It is likely that this ridge roll was replaced by the National Park Service at the same time that the ridge roll was at the Double Keepers' Duplex Residence (HS-11).

Figure 117

View of the brick Privy (HS-15) south of the Double Keepers' Duplex Residence (HS-11), 1973. Note the wood plank door.

Figure 118

View of the south elevation of the brick privy (HS-15) which served the Double Keepers' Duplex Residence (HS-11), 1995.

Figure 119

Detail view of the deteriorated wood fascia at the brick Privy (HS-15), 1995.

The 1995 physical investigation revealed that an extensive amount of the brick and mortar, and almost all of the plaster, had deteriorated at the cleanout along the east wall. A non-period plywood cleanout cover had also deteriorated.

Boathouse (HS-17)

Exterior Fabric Analysis

The exterior walls of the wood frame boathouse are covered with board-and-batten siding, which is painted white. The siding consists of 7/8" thick x 12" wide boards and 2" wide battens. The bottom few inches of several of the pieces of vertical board siding have deteriorated, presumably as a result of the buildup of sand at the walls which has limited water drainage away from the structure. Some large holes near grade in the wood boards were observed, likely the result of deterioration. Some of the boards have been temporarily replaced with plywood. Additionally, a 6' - 0" piece of batten is missing from the south elevation just east of the door opening. At the top of the walls there is a flat wood board frieze, which is also painted white. National Park Service maintenance records indicate that the exterior of the boathouse was painted in 1981, 1987, and again in 1990. The roof is covered with asphalt shingles, which replaced unpainted wood shingles, and were installed by the National Park Service in 1976. The 1995 physical investigation revealed that an area of the asphalt shingles have pulled loose at approximately the center of the west slope of the roof.

The door on the south elevation and all of the windows were boarded up with plywood during the 1995 physi-

cal investigation. Further, the large swinging door on the north elevation, which previously provided access for the boat into the structure, was removed, and the opening covered over with bolted plywood. Previously, a 1990 physical investigation revealed that the only remaining original window sash in the structure was at the east window.

Structural Analysis

Physical investigation revealed that the foundation of the boathouse (HS-17) consists of 6" x 6" heavy wood timbers which are directly on grade. In 1990, these timbers had severely deteriorated at the west and south elevations, and the east elevation timber had been replaced with a vertical board as part of the emergency stabilization efforts by the National Park Service.

The wood framing of the structure consists of 4" x 4" posts and 2" x 4" horizontal wood members. Several of the vertical wood posts had deteriorated near the bottom, or were damaged by animals prior to the 1990 physical investigation. Furthermore, as part of the stabilization of the structure, the National Park Service installed wood bracing to supplement the original framing throughout the interior of the boathouse, as seen in **Figure 120**.

The roof framing of the structure consists of 2" x 4" rafter joists which meet at the ridge; there is no ridge board. The roof sheathing consists of 1" thick wood boards of varying sizes.

Interior Fabric Analysis

The interior walls of the structure are the exposed, unfinished wood framing of the structure. There are also two 14" diagonal wood brackets, which extend perpendicularly from the south wall of the structure, as seen in **Figure 121**. Oars were presumably stored on these brackets. There is not a constructed floor within the boathouse, it is just exposed grade (sand).

Garage (HS-09a)

Exterior Fabric Analysis

The Garage was constructed in 1954 during the tenure of Dick Miller as Officer in Charge. According to Miller, the materials were partially salvaged from the wood/coal sheds that had been razed that year. The 1995 physical investigation revealed that the garage has wood shiplap siding that is painted white. The flat roof is

Figure 120

View of the interior of the Boathouse (HS-17), 1991, showing the additional wood bracing installed by the National Park Service.

Figure 121

View of the interior of the Boathouse (HS-17), 1991. Note the wood hangar which was probably used for oar storage.

covered with asphalt roofing material, which National Park Service records indicate is a 90 lb. felt. A small roof extends the full width of the south elevation over the two overhead metal doors and is covered with the same asphalt roofing as the main roof. The garage has four windows, all of which have fixed, two-paned sashes.

Interior Fabric Analysis

The light wood framing of the structure, both at the walls and at the ceiling, is exposed at the interior of the structure and the floor is a concrete slab on grade. Both the walls and the floor shows signs of deterioration.

Site Utilities

Currently, there is no electricity available at the site. Due to the isolated location of the Au Sable Light Station, generators supplied all of the electric power for the site, and were historically located in the Fog Signal Building (HS-16). The fuel used to power these generators was stored in an underground tank located south of the Fog Signal Building (HS-16). This tank, along with other fuel tanks located on the site, were removed through the combined efforts of the Coast Guard and the National Park Service in 1983. The generators were also removed from the Fog Signal Building (HS-16) when the station was automated in 1958. However, remnants of the electric feed lines remain, and historic drawings show the former location of all of the components of the station's electrical system.

Currently, there is no telephone service at the site. Historically, a telephone line ran from Grand Marais over the Grand Sable Dunes to the lighthouse complex. This line was connected to the Coast Guard station in Grand Marais, and continued on to the light station at Whitefish Point. Historic photographs indicate the location of the telephone poles on the Au Sable site.

Currently, there is no water service at the site. Historically, each dwelling had a cistern in its respective basement. These cisterns collected rainwater from their respective roofs through extensive drainage systems. In addition, excess water was pumped through pipes from the steam boilers at the Fog Signal Building (HS-16) into the cisterns of the dwellings. Prior to the construction of the cisterns, it is assumed that water was hand drawn from the lake and carried to the dwellings in buckets. In 1951, a 220' deep well was dug west of the Keeper's Dwelling (HS-09) which is extant, but is no longer in use.

Currently, there are no public toilet facilities at the site.

Asbestos Testing

A bulk asbestos analysis was undertaken by Braun Environmental Laboratories of Minneapolis in October of 1990, under a separate contract with Enviroscience, Inc., also of Minneapolis. Braun Environmental Laboratories analyzed twelve bulk material samples for asbestos fiber content, as requested by Enviroscience, Inc. The methodology of the analysis was in accordance with the Environmental Protection Agency's (EPA) method 40 CFR, Part 763, Ch. 1, (7-1-87 edition), subpart F, appendix A. Samples were examined for homogeneity and if any sample contained separate layered components, each layer was analyzed separately.

Braun concluded that the, "PLM analysis has resulted in the detection of asbestos in 2 of the 12 samples submitted."[14] Both of these samples were taken in the Keeper's Dwelling (HS-09). One of these samples was taken from Room #01 "above the washtubs" and the second sample, which was found to have asbestos content was taken from Room #01's, "duct seam". Both samples were a white fibrous material, with the first listed as a type of insulation. It is assumed that all of the asbestos was abated from the Keeper's Dwelling (HS-09) by the National Park Service prior to the 1995 physical investigation.

Paint Analysis

A paint analysis and report was prepared by David Arbogast, Architectural Conservator, under a separate contract with the National Park Service, Midwest Regional Office. This effort was undertaken in January of 1991. One hundred and fifty eight samples were collected by Enviroscience, Inc. (with the exclusion of four taken by Mark Chavez). These samples were visually analyzed through an optical Olympus microscope and matched to the Munsell System of Color utilizing natural northern light. David Arbogast states that, "only opaque, pigmented layers (i.e. paint layers) were matched. It is impossible to color match finishes such as metallic paints and leafs and varnishes because their color is directly affected by their translucency and reflectance."[15] With respect to this analysis, Arbogast states that, "The samples proved to be much more in-

teresting than initially expected. As will be seen, they included a variety of paint types, varnishes, and metallic finishes. Although a relatively limited palette of colors was found, there were some very notable and interesting exceptions..."[16] Arbogast also explains the discrepancies in the several paint colors found throughout the structures, especially at the Keeper's Dwelling (HS-09). He states that, "For example, although numerous variations of green paint were seen, it is unlikely that more than one or two standard shades of green were used at the time, with the differences being attributed to variations between cans of paint and the natural aging process of the green pigments."[17]

It appears that Arbogast has been able to determine the original finish in most of the rooms of the Keeper's Dwelling (HS-09). This information proves beneficial to the restoration of the interior materials and finishes, as the original finish would have been what existed during the period of restoration. The structure was constructed in 1909, and the Pictured Rocks National Lakeshore has chosen the period of 1909 - 1910 as the period of restoration and interpretation of the Au Sable Light Station.

1 Bruce A. Jones, *Evaluative Investigations at the Au Sable Light Station, Pictured Rocks National Lakeshore, Michigan, 1990*. Prepared for the U.S. Department of the Interior, National Park Service, Midwest Archeological Center (Lincoln, NE: 1994), 5.

2 Enviroscience, Inc. *Historic Structures Report, 95% Submittal, Au Sable Lighthouse Complex, Pictured Rocks National Lakeshore, Michigan*. Prepared for the U.S. Department of the Interior, National Park Service, Office of Planning and Resource Preservation, Division of Cultural Resources Management, Omaha, Nebraska (Eden Prairie, MN: 1991), VI-32.

3 Enviroscience, Section D, p.2.

4 Jones, 6.

5 Ralph R. Tinkham, "Description of Buildings, Premises, Equipment, Etc. at Au Sable Light-Station, Michigan, June 7, 1909," Record Group 26, United States Coast Guard, Bureau of Lighthouses, 1911-1939, National Archives, p.6.

6 Chavez., 14.

7 John J. Ochman, *Final Report on the Restoration of the Double Keeper's Dwelling, HS-11, Au Sable Point Light Station, Pictured Rocks National Lakeshore, Grant #26-89-LH-26*. Prepared for the U.S. Department of the Interior, National Park Service, Pictured Rocks National Lakeshore (Munising, MI: 1989), 2.

8 Chavez, 15.

9 Chavez, 16.

10 Chavez., 17.

11 Chavez., 31.

12 Jones, 6.

13 Enviroscience, Inc., XIII-2.

14 Enviroscience., Section E, p.1.

15 David Arbogast, "Paint Analysis, Au Sable Lighthouse Complex, Pictured Rocks National Lakeshore." Prepared for the U.S. Department of the Interior, National Park Service, Midwest Regional Office, Omaha, Nebraska (January 1991), 1.

16 Arbogast, 2.

17 Arbogast, 87.

Part G:
Design Recommendations

Part G: Design Recommendations

Secretary of the Interior's Standards for the Treatment of Historic Properties

Rehabilitation, as defined by the Secretary of the Interior's Standards for Rehabilitation, is the process of returning a property to a state of utility, through repair or alteration, which makes possible an efficient contemporary use while preserving those portions and features of the property which are significant to its historic, architectural, and cultural composition. The distinguishing historic qualities and character of the Au Sable Light Station will be preserved through the restoration of all existing exterior and interior fabric, where possible, and the reconstruction of missing elements as necessary. The Keeper's Dwelling (HS-09) will be rehabilitated to provide living quarters for National Park Service personnel. Recommendations will be provided so that future plans and specifications for each structure will be designed to have minimal impact on the structure's existing historic fabric.

Restoration, as defined by the Secretary of the Interior's Standards for the Treatment of Historic Properties, is undertaken to, "depict a property at a particular period of time in its history, while removing evidence of other periods."[1] Restoration of the Double Keepers' Duplex Residence (HS-11), the attached passageway, and the Tower (HS-10) to their 1909 - 1910 appearance has already been initiated by the National Park Service and will be completed.

Site Recommendations Relative to the Operation of the Complex

Site Utilities

Production and Distribution of Electricity

The need for electricity at the site is essential for occupancy by park personnel, and for visitor comfort and safety. It is needed for a variety of reasons pertaining to the operation of the site, including: lighting, domestic electricity, domestic hot water service, fire suppression systems, and supplemental heating. Historically, a gas-powered generator, which was located in the Fog Signal Building (HS-16), provided the electricity for the entire complex. Underground lines fed the electricity from the Fog Signal Building to the other structures of the complex. Only minimal remnants of this electrical system are extant. Three options are possible for future electrical production at the complex. These options are presented in the recommended order of consideration, based upon both practicality and cost-effectiveness.

Option 1: This option involves the installation of an updated version of the historic electrical system, including the installation of a generator and a battery bank, with an AC invertor, in the Fog Signal Building (HS-16), and new underground electrical lines to the other structures at the complex. The generator would run on liquid propane gas, a fuel which is highly efficient and which could also be used to heat the occupied buildings at the complex. The use of only one type of fuel at the site would minimize the transportation of fuel to this remote site. Further, the high efficiency of liquid propane, and its minimal ventilation requirements, would allow the furnaces to be located in the basements of the dwellings.

There are two options for the on-site storage of the liquid propane. The first option would be to install new underground fuel tanks or above ground tanks, which are hidden from the historic site, and which would be connected to the generator and to the furnaces by buried pipelines. The other option would involve the installation of the fuel tanks for the dwellings at each of the existing historic concrete saddle stands, which historically held the fuel tanks. The set of saddles at the Double Keepers' Duplex Residence (HS-11) is located along the south elevation, and the set at the Keeper's Dwelling (HS-09) is located along the north elevation.

The use of liquid propane has historic precedence at the complex as it was the fuel used when the complex was in operation. Further, the advantage of updating the historic electric system is that it requires the least amount of introduction of new features to the site. And, those parts of the historic system that would still be visible could be interpreted as part of the technology that was inherently involved in running the complex. The downside of Option 1 is that, although the utilization of the Fog Signal Building (HS-16) for electric generation follows historic precedent, interpretation of the building to visitors would be limited, due to the noise and safety issues related to the electric generation system.

Option 2: This option would involve the utilization of wind power to create the electricity required for the complex, and would require the construction of a windmill in a visually non-obtrusive location. An

underground line would then run from the windmill to a battery bank. This battery bank could be located in the Fog Signal Building (HS-16), in the basement of one of the dwellings, or in the Brick Oil House (HS-13) if space permits. Again, as with Option #1, an AC invertor is recommended in conjunction with the battery bank, and the installation of underground lines to feed the electricity from the invertor to the individual structures of the complex. Although this method of producing electricity would have the least negative impact visually, physically, and audibly on the historic site, the size and placement of the windmill structure would need to be further investigated to determine its viability. Further, the presence of a windmill system would not eliminate the need for a backup (gas-powered) electric generation system. Therefore, a generator would also have to be installed at the complex, preferably in a location recommended in Option 1.

Option 3: This option entails the installation of solar panels on or near the site, and a battery bank for the storage of the energy collected. The solar panels would have to be located in as non-obtrusive a location as possible. However, due to the extensive surface area of the solar panels required to supply a sufficient amount of electricity to the complex, it would be difficult to place them without creating a significant visual and physical impact on the site. Furthermore, as with a windmill system, a backup, gas-powered electrical generation system would still be required, in addition to the solar panel system.

Water System

The existing well (dug in 1978), should be further investigated to determine its potential use as a source for providing domestic water to the living quarters for National Park Service staff, as proposed in the rehabilitation plans for the Keeper's Dwelling (HS-09). If the existing well cannot be updated and an entirely new well is required, a considerable additional expense would be incurred which would be dependent upon the required depth of the well. The use of well water assumes the installation of a power source for the required pumps.

Assuming the existing well is updated, and based on the average daily use of water for four persons occupying a dwelling, a water storage tank would be still be needed. This storage tank could be located out of view of the historic site, near the existing well. The tank would need to be pressurized to provide hot water service and sufficient water pressure to the second floor of the dwelling. A bladder tank would prove sufficient for domestic water service; however, a hydropneumatic tank and pump would be needed for the proposed fire-suppression system. Therefore, a hydropneumatic tank, which would be adequately designed for the fire suppression system, should be installed and also used for domestic water service. This should be accomplished through the installation of two separate lines, one water line for domestic water and one for fire suppression. Adapting the existing cistern in the basement of the Keeper's Dwelling (HS-09), which is another alternative, is not recommended because the potential impact of the required alterations to bring it up to contemporary standards of quality would significantly impact this historical element of the structure. The cistern should be preserved as an artifact of the lighthouse complex's history, and be interpreted as such.

Sanitation

Due to the remote location of the complex within the Lakeshore, it is recommended that public vault toilets be constructed in a visually non-obtrusive location near the edge of the historic site. In addition to underground storage tanks for the sanitation waste generated in the rehabilitated Keeper's Dwelling (HS-09), these toilets would be operated and maintained by the National Park Service.

In their 1991 report, Enviroscience, Inc. stated that, "For on-site sewage treatment, soil conditions at the Au Sable site can be characterized as being sandy with percolation rates from 0.1 to 5 minutes per inch. Mottled soil evidence of groundwater levels on the site is evident from the surface to depths of 36 inches."[2] This statement suggests that although the rate of percolation is sufficient for a septic field, the high presence of groundwater, and the amount of clay at the site, most likely restrict proper drainage during certain seasons. Therefore, a 500 gallon underground septic tank is recommended. At a minimum, the existing road to the lighthouse complex should be repaired and maintained to sufficiently provide proper access to the site for the equipment required for pumping the septic tank.

Gray Water Treatment

It is recommended that gray water be disposed of through a drainage field. A 30 to 40 square foot field should prove sufficient for the proper drainage of gray

water generated at the complex. Further investigation of the soil conditions of the site should be undertaken prior to the installation of this system.

Fire Protection

The Cultural Resource Management Plan of the National Park Service states that,

> when warranted by the significance of a historic structure or of the museum objects in a non-historic structure, adequate fire detection, warning, and suppression system will be installed. Fire-fighting personnel will be advised of any peculiarities or dangers inherent in a structure and any objects to be given priority for protection or rescue. Park personnel will receive training in fire prevention and suppression with hand-held extinguishers at historic structures and museums...[3]

Therefore, it is recommended, due to the remote location of the lighthouse complex and the historic integrity of its structures, that the Keeper's Dwelling (HS-09), the Double Keepers' Duplex Residence (HS-11), and the Fog Signal Building (HS-16) be protected by a water sprinkler fire suppression system. The system's design should conform to NFPA Pamphlet #13 and #22. It is also recommended that this system be supplied by a hydropneumatic tank and pump, which would also have a separate line to provide domestic water service to the Keeper's Dwelling (HS-09). Sufficient fire extinguishers and fire prevention manuals should also be located on site for the use of National Park Service personnel.

It should be pointed out that protection during the winter months is not possible as the fire suppression system must be deactivated when the island is not occupied. Damage from uncontrolled water flow and ice would destroy the buildings we are attempting to protect.

The following discussion outlines the advantages and disadvantages of the various types of fire suppression systems that could be employed for this project.

For maximum protection, the fire suppression systems should provide protection for all occupied areas, including basements. Per NFPA requirements, the systems should be hydraulically designed for light hazard protection. The following four system types offer possible solutions to the problem:

Pre-Action System

Of the four systems, this system offers one of the better solutions to the problem. Unfortunately, it is also one of the most expensive.

A pre-action system consists of standard fused sprinkler heads and piping along with a pre-action valve which is actuated by rate-of-rise heat detectors. The piping system is initially empty. An alarm signal from a heat detector opens the pre-action valve, resulting in water becoming available to the system. At the same time, an alarm signal can be broadcast to a monitoring station notifying that there is a risk of fire in the building. Water is only discharged to the space when the fusible link on a sprinkler head melts from the heat of a fire.

In the event of an electrical system failure, the system will be filled with water so when a sprinkler fusible link melts the system will continue to provide protection for the building.

The advantages of this system include:

- Early warning of a possible fire.
- The excellent protection from water damage due to tampering with or accidental damage to a sprinkler head, as there will be no water in the system unless a heat detector has been activated.
- The portions of the system beyond the pre-action valve are not subject to freezing, as there is normally no water in the piping.

Disadvantages include:

- The installed cost of this system is considerably above the cost of a normal, water-filled system.
- Subsequent to an electrical system failure the system must be totally drained of water.

Firecycle System

The firecycle system is very similar to the Pre-action system as it requires both a signal from an area heat detector and the opening of a fusible link on a sprinkler head before water discharge can occur.

This system possesses two additional features as, after activation, the water discharge is automatically turned off when the temperature at the heat detector is reduced below the detector activation temperature, indicating that the fire has been extinquished. The water is turned back on if the temperature again rises above the detector activation temperature. As with the preaction system, an alarm signal can be broadcast to a monitoring station notifying that there is a risk of fire in the building when a heat detector alarms.

The advantages of this system include:

- Early warning of a possible fire.
- As there will be no water in the system unless a heat detector has been activated, this system provides the best possible protection from water damage due, not only to tampering with or accidental damage to a sprinkler head, but also to the fact the discharge will be deactivated once an actual fire has been extinguished.
- The portions of the system beyond the preaction valve are not subject to freezing, as there is normally no water in the piping.

Disadvantages include:

- The installed cost of this system is considerable above the cost of a normal, water-filled system and is the most expensive of the systems considered in this report.
- Subsequent to an electrical system failure, the system must be totally drained of water.

Dry-pipe System

Under normal conditions, the piping in this system is empty. The system is pressurized with air from an air compressor. Sprinkler heads are fused type. If a sprinkler head is activated, the drop in pressure opens a dry pipe system valve and allows water to flow into the system.

The advantages of this system include:

- This system provides good protection from freezing, as there is initially no water in the system.

Disadvantages include:

- The installed cost of this system is approximately 20% above the cost of a normal, water-filled system.
- Damage to or tampering with a sprinkler head will result in immediate discharge of water.
- In the event of an electrical system failure, the system is inoperable and the dry-pipe valve will not open in the event of a fire.
- At present, quick response heads (see below) are not available for dry-pipe systems.

Wet Pipe System

This system represents 90% of the sprinkler systems in this country. It consists of fused sprinkler heads served by a piping system that is always filled with liquid. This system is the least expensive of the systems discussed in this report. Systems installed in areas exposed to freezing temperatures must be filled with a glycol solution to prevent freezing of the liquid.

Advantages include:

- Lowest first cost.

Disadvantages include:

- Damage to or tampering with a sprinkler head will result in immediate discharge of water into the protected space.
- No early warning feature.

Sprinkler Heads

Normal, "standard," sprinkler heads are equipped with fusible links which melts at 165 degrees F. Recently, sprinkler heads have been developed which will open at a considerably lower temperature (135 degrees F.) Due to their heightened sensitivity, these "quick response" heads cannot be employed in all applications. They are commonly restricted to residential use. However, the added protection they provide warrant serious consideration for this project.

Piping System

The existing structures offer few opportunities to con-

ceal the sprinkler system piping. The high cost of architectural renovations in an attempt to conceal sprinkler piping cannot be justified. Fortunately, through the use of small diameter copper piping and the judicous location of sprinkler heads, the visual impact of the sprinkler system can be minimized. Furthermore, installation of the system during the replacement of extant wall and ceiling plaster will provide opportunities for hiding components within the wall fabric.

Recommendations

Due to the irreplaceable value of the buildings, the selection of a fire suppression system must be given careful consideration. There is no question that the firecycle system affords the maximum protection, as this system minimizes the extent of damage, if any, from the flow of water. The pre-action system offers slightly less protection at a slight reduction in cost. Unfortunately the initial cost of both these systems is quite high, and it is questionable that either one can be considered cost effective.

The most cost effective and reliable system is the basic hydraulically designed standard sprinkler system. This is recommended to serve the project. The sprinkler heads should be of the "quick response" type to assure that the head will discharge early in the fire and allow the best chance for rapid quenching of the fire. Recently, "quick response" heads have become available in a sidewall type. These heads can be mounted directly on the piping at the corners of ceilings and walls, thus minimizing the intrusion of the sprinkler system into the appearance of the rooms.

Lightning Protection

It is not known, nor is it documented, whether or not the current lightning protection systems, at both the tower (HS-10) and the Double Keepers' Duplex Residence (HS-11), were installed to meet the requirements of Underwriter Laboratories, Inc. A licensed installer/designer in this trade should further evaluate the existing condition of both systems, according to UL standards.

Handicapped Accessibility

National Park Service guidelines state that, "The National Park Service will provide the highest feasible level of physical access for disabled persons to historic properties, consistent with the preservation of the properties' significant historical attributes... If it is determined that modification of the particular features would destroy a property's significance, however, such modifications will not be made."[4] In accordance with this guideline, it is recommended to provide handicapped accessibility to the first floors of both the Keeper's Dwelling (HS-09) and the Double Keepers' Duplex Residence (HS-11), as well as to the Fog Signal Building (HS-16). New wood ramps that meet Uniform Federal Accessibility Standards for length and width should be constructed at the designated public entrances to each of these three structures. Providing access to the second floor at either of the dwellings, or to the upper levels of the tower (HS-10) is impractical from both an economical standpoint and from a preservation standpoint, in that each structure's architectural integrity would be compromised by the installation of larger ramps or elevator shafts. Furthermore, any electricity generated at the remote site would not be sufficient enough to also run an elevator. The introduction of an expanded and more capable electrical system to handle an elevator(s) would be impractical.

The existing walk system that provides the path of circulation throughout the Au Sable Light Station is comprised of concrete walks that range from 18" to 24" in width. The required clear width of an accessible route is 36" at the minimum, therefore those historic walks which are chosen to provide the flow of public visitation between the individual structures should be expanded by the addition of new material to create the required width. The joints between the old and new material should remain clearly marked, and the joints within the new material should be staggered with the old joints. The surfaces of the existing walks may also need leveling. This would provide handicapped accessibility between the structures, and, at the same time, preserve the historic circulation pattern of the complex.

The reconstructed historic walkway system would need to be supplemented with additional handicapped accessible paths both to and from the proposed parking area near the site. It is important to also note that, due to the unusually steep grade and unstable nature (consistently shifting sand) of the site between the Fog Signal Building (HS-16) and the Boathouse (HS-17), a handicapped accessible route to the boathouse is not readily achievable or practical. Such a route, which may exceed a 5% slope, could be rated in accordance with the "challenge level" identification system that are a

part of the National Park Service's Outdoor Accessibility Guidelines.

With limited costs involved, handicapped accessibility is readily achievable at all of the remaining outbuildings of the complex through the manipulation of grade. Further study would be required to determine the ultimate use of each outbuilding, and whether or not they should be open to the public.

Keeper's Dwelling (HS-09)

General Approach Toward Recommendations

It is recommended that all or part of the Keeper's Dwelling (HS-09) be rehabilitated to serve as living quarters for National Park Service personnel. This rehabilitation would be undertaken in accordance with No. 9 of the Secretary of the Interior's Standards for Rehabilitation, which states that, "Contemporary design for alterations and additions to existing properties shall not be discouraged when such alterations and additions do not destroy significant historical, architectural or cultural material, and such design is compatible with the size, scale, color, material, and character of the property, neighborhood, or environment."[5] Based on the decision to use at least a portion, if not all, of the Keeper's Dwelling (HS-09) as living quarters, and in keeping with the Secretary of the Interior's Standards, three preliminary design concepts have been developed. All three concepts take advantage of the historical character of this particular structure while, where feasible, maintaining the original function of each of the rooms. These concepts also minimize, to the extent possible, the destruction of the historic fabric and the amount of new construction that is required. This approach to the rehabilitation of the structure is based upon No. 10 of the Secretary of the Interior's Standards which states that, "Wherever possible, new additions or alterations to structures should be done in a manner that if such additions or alterations were to be removed in the future, the essential form and integrity of the structure would be unimpaired."[6] Further, the concepts take into consideration the results of a National Park Service housing survey conducted in September 1988 of the agency's seasonal employees. The survey asked the employees to rank their privacy priorities and needs. According to the results, the employees ranked the sleeping areas of their quarters as their first priority; the toilet and sink area as their second; the shower and bathing area as their third; and, the kitchen area as their fourth.

Building Interior Alternatives

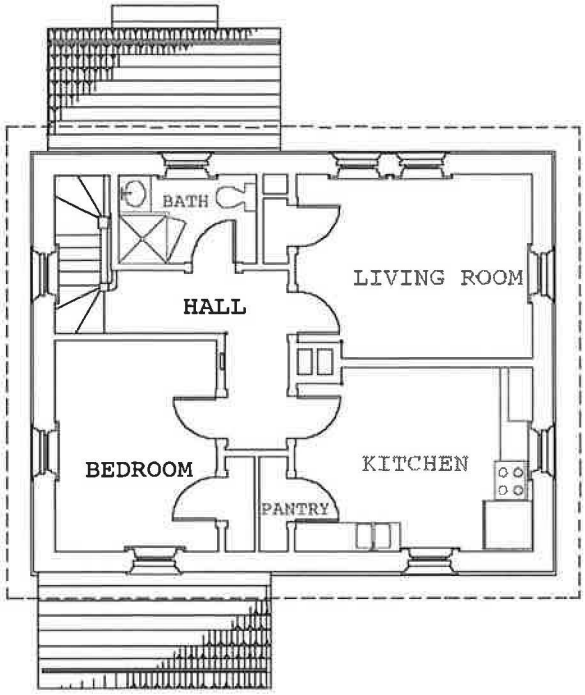
Concept A: This concept proposes the restoration of the first floor of the Keeper's Dwelling (HS-09) to its 1909 - 1910 appearance, and the utilization of the space as a visitor contact facility. The visitor contact facility would entail the installation of exhibits and visitor information that would not alter or destroy the historic fabric of the structure. The second floor of the structure would be rehabilitated into living quarters for National Park Service personnel. This would involve updating the existing bathroom, and converting the southeast bedroom into the kitchen because it is spacious enough to accommodate both kitchen fixtures and a dining space. The southwest bedroom would remain a bedroom, and the northeast bedroom would be converted into the living room, since it provides the best view from its windows.

Analysis of Concept A: This concept would entail minimal changes to the historic fabric of the structure, especially at the first floor. However, the original division and usage of the spaces throughout the dwelling would be significantly altered. Originally, the structure served as a single-family dwelling. This concept would convert the first floor to a non-historic use, while room designations and functions would be significantly altered at the second floor. Further, Concept A only provides a second floor residence, and handicapped accessibility is not readily achievable to the second floor of the structure.

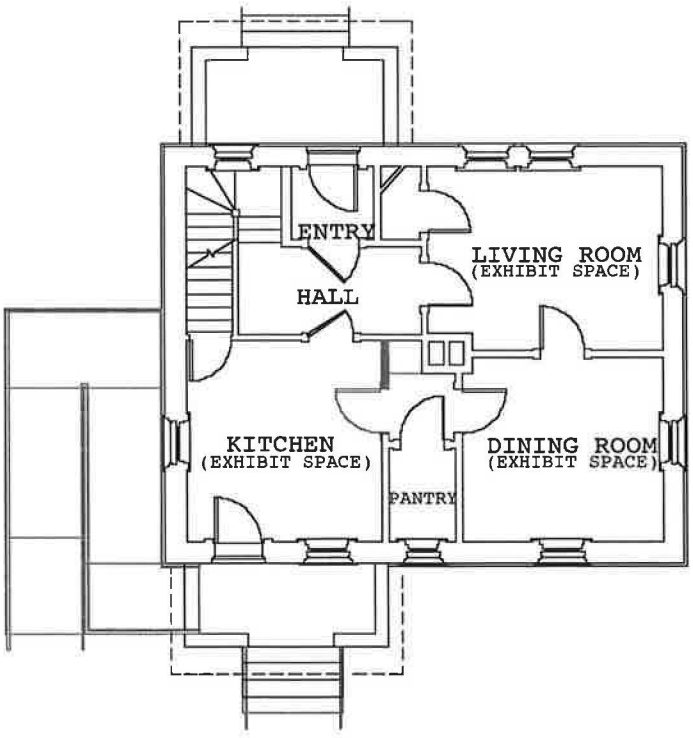
Concept B: This concept proposes utilizing the entire Keeper's Dwelling (HS-09) as living quarters for National Park Service personnel, which would entail dividing the structure into two separate residences. Each floor would contain a separate residence, either for an individual or a small family, consisting of a kitchen, bedroom, living room, and bathroom.

Analysis of Concept B: This concept would have a greater impact on the historic fabric of the structure because of the introduction of a bathroom at the first floor and a kitchen at the second floor; two rooms which did not exist historically and would require a significant amount of alteration. However, this concept does meet all of the highest privacy priorities of the Park Service's seasonal employees, and it allows the provi-

Concept A

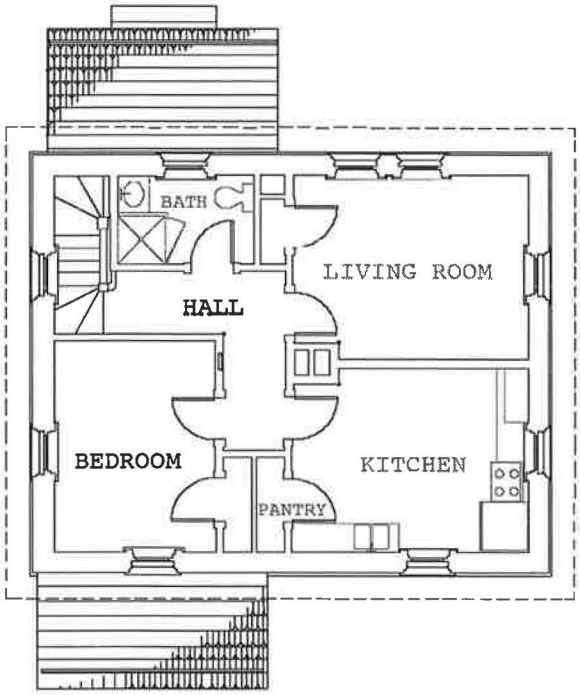


Second Floor



First Floor

Concept B



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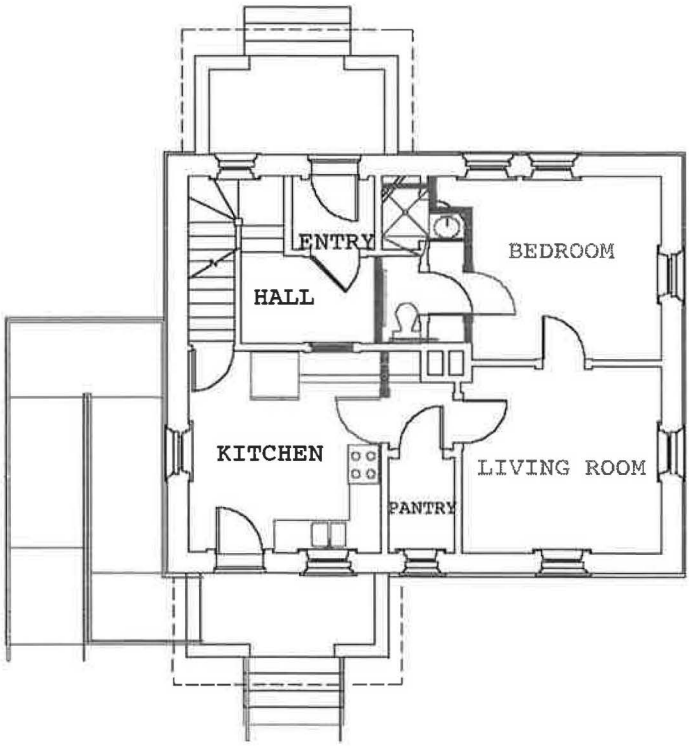
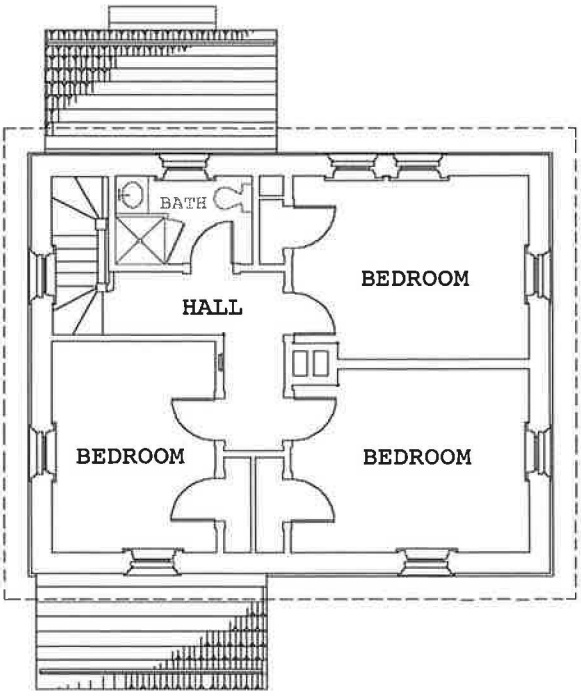
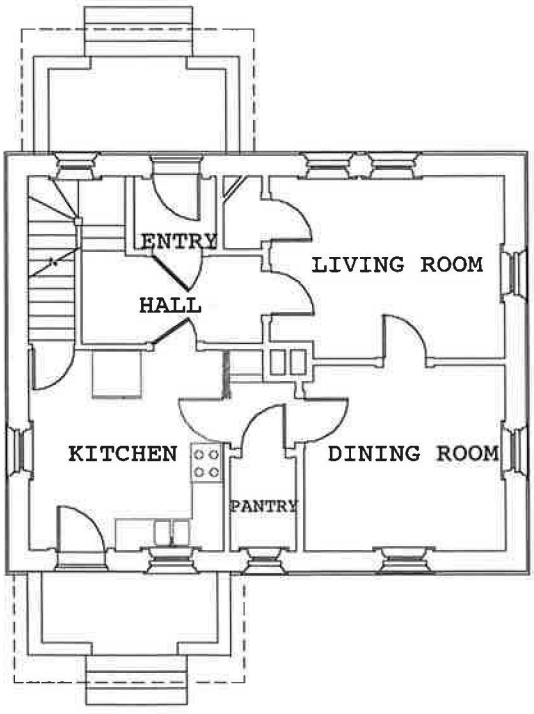


First Floor

Concept C



Second Floor



First Floor

sion of an entirely handicapped accessible apartment at the first floor.

Concept C: This concept proposes the utilization of the entire Keeper's Dwelling (HS-09) as a single residence. This would involve reusing the structure as it was originally built and used. With this concept, the dwelling could either be utilized as a single-family or a dormitory-style (personal bedrooms with shared common spaces) residence.

Analysis of Concept C: This concept would involve the least amount of destruction of the historic fabric, while providing the highest priority, private sleeping areas, to the seasonal employees occupying the structure.

Recommended Treatments

Based on the information obtained from historic documents and photographic research, as well as from physical investigation, the following treatment recommendations are proposed for the rehabilitation and the contemporary use of the Keeper's Dwelling (HS-09). These recommendations are based on the assumption that the entire exterior of the building will be restored to its 1909 - 1910 appearance, as determined by the Pictured Rocks National Lakeshore. Furthermore, as much material dating from period of interpretation (in this case, the date of construction) should be preserved as possible. When historic material is removed, a representative sample should be accessioned into the park museum collection.

Building Exterior

Roof: There are two alternative approaches for the treatment of the roof of the Keeper's Dwelling (HS-09). Alternative No. 1 is a short-term approach which attempts to prolong the life of the existing stamped sheet metal shingles. This approach could be easily incorporated as part of a maintenance item while Alternative No. 2 could be part of a phased approach. Alternative No. 2 provides recommendations which are the most conducive to the longevity of the building, and should be considered as part of a comprehensive, long-term restoration program.

Regardless of which alternative is undertaken, there are several exterior issues which should be addressed and completed prior to the undertaking of any of the recommended interior treatments. At most areas of the roof where there are intersections, particularly at the attic dormers and at the chimney, the lack of proper flashing has caused severe damage to the interior of the structure. The shingles at these areas should be removed, and proper metal flashing installed and properly sealed. If any deteriorated sheathing is observed when the shingles are removed, they should be replaced with sheathing material. After the flashing installation, the existing shingles (or new shingles, based upon the treatment chosen) should be reinstalled. Whichever alternative is undertaken, a cyclical maintenance program for the entire roof system should be written and followed by National Park Service personnel.

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

1. Removal of all loose paint and scaling rust with a gentle wire brush and hand-scraping.

2. Repair of individual holes with mastic compound or metal patches.

3. Application of a rust-inhibitive primer immediately after the completion of steps 1 and 2.

4. Application of the paint, with the color selected according to the paint analysis, after the completion of step 3.

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

1. Removal of the existing roof shingles, which should be properly disposed of off the site.

2. Installation of new stamped sheet metal shingles which match the existing ones.

3. Application of a rust-inhibitive primer followed by the paint, with the color selected according to the paint analysis.

Gutters: All areas of the built-in gutter which have deteriorated should be replaced in kind. Following wood replacement, new sheet metal flashing should be installed and painted according to the recommendations of the paint analysis. The gutters should be tied into the existing downspout locations. There are three options for disposing of rainwater collected from the roof:

1. Continue to allow the downspouts to drain at grade. While the least costly solution in the short term, this may be contributing to moisture problems in the basement masonry.

2. Re-connect the downspouts to the historic boots and route water to the cistern. This was the original system. However, this is only advisable if water from the cistern will used as part of the fire suppression system or as irrigation for site plantings.

3. Re-connect the downspouts to the historic boots, and tie the boots into a new perimeter drain system. As the recommended treatments below include excavation of the building perimeter, new drains could be installed while the perimeter foundation is exposed. The collected water should then be routed to a drywell or otherwise drained offsite. This option is recommended as the best long-term solution.

Exterior Brick Surfaces: The spidering pattern of efflorescence (soluble salt film), especially at the surface of the vitrified brick at the north elevation, is due to the structure's orientation toward the lake which is the coldest and therefore the worst, is the result of moisture from within the cavity of the exterior walls working its way out. These salt encrustations should be removed (as well as at any other locations where they are observed). This removal should first be undertaken by hand, by washing and rinsing the brick surface. If this process proves unsuccessful, a mild chemical cleanser should be tested and then applied for removal. However, the condensation problem at the cavity within the exterior walls, which is causing the deterioration of both the interior and exterior surfaces of the exterior walls, should be mitigated prior to any exterior surface treatments. The associated hairline cracking, also visible at the north elevation, and in a few other remote areas of the exterior walls, is likely the result of pressure due to the fluctuation of temperature during seasonal changes, especially in the spring. In addition, several small areas of mortar deterioration, mainly at the porch walls, should be tuckpointed with mortar that is compatible with the physical and visual characteristics of the existing mortar.

As part of a comprehensive restoration program the entire perimeter of the foundation should be excavated and the cement parge coat, where deteriorated, should be removed. Following removal, areas of deteriorated mortar joints should be tuckpointed and a new parge coat applied to the entire exterior surface of the walls. Areas of mortar deterioration evident from the interior (in the basement), should also be tuckpointed.

The lichen, which is growing on the cast stone water table and brick surfaces, especially at the west elevation, should be removed with water and a stiff natural bristle brush, after soaking. Following its removal, if stains are observed on the masonry surfaces, they should be removed with carefully chosen and tested organic solvents. Furthermore, as part of a comprehensive restoration program, a chemical agent can be applied to the masonry surface to prevent future organic growth.

Exterior Wood Surfaces: The paint should be removed down to either the bare wood or sound paint from the wood surfaces at both of the porches, including the ceilings, brackets, beaded board at the ends of the shed roofs, and the eaves. Any deteriorated areas that are revealed following paint removal should be consolidated with a two-part epoxy treatment system prior to new paint application. Paint preparation should then include the sanding of the locations of paint buildup, and then feathering them to the adjacent sound surfaces. All of the wood surfaces should be painted according to the findings of the paint analysis.

Windows: As part of a comprehensive restoration program, and to improve heat efficiency within the dwelling, all of the windows should be removed and completely restored. Following removal, plywood shutters should be installed for both security reasons, and to protect the building's existing historic fabric. Window restoration should include: paint removal with a chemical stripper, consolidation of any areas of deteriorated wood, joint repairs, and new glazing putty. All of the windows should the be refinished, according to the findings of the paint analysis, and then reinstalled. New sash cords will also need to be installed at each of

the windows and new hardware, where required, as noted on the window schedule.

Building Systems

Structural System

Based upon physical investigation (very few knots and clear, straight grain were observed) and historical precedence (the extant Split Rock lighthouse specifications call for white pine, "free of the usual defects"), a select structural white pine, with a stress value of 1400 psi, was used to determine the live load limits of the Keeper's Dwelling (HS-09). The tables used to calculate the load limits are included in Appendix A. All of the load limit calculations assume that there will be no attic live loads.

Based upon the existing joist capacities in the structure, the superimposed load limit at the west side of the structure (at both floor levels) is 100 psf, and at the east end of the structure, is in excess of 120 psf. However, at the west side of the building, the live load is limited to between 25 and 30 psf by the 7 3/4" x 7 3/4" east-west spanning beam. Based on the rehabilitation of the Keeper's Dwelling (HS-09) as living quarters for National Park Service personnel, the minimum live load requirement, as stated in the BOCA National Building Code, is 30 psf in the sleeping rooms and 40 psf elsewhere. However, based on Concept A of the proposed alternatives for the rehabilitation of the structure, the first floor would serve as a visitor contact facility, and therefore would require a minimum live load limit of 100 psf. The live load limit can be increased to over 100 psf at both floors of the structure, however, by adding a post shore at the midspan of the 7 3/4" x 7 3/4" beam at each side of the chimney (at the west side of the structure). The live load is currently 100 psf at the east side of the structure, and therefore does not require shoring because it is assumed that the masonry wall of the coal room supports the beam.

Mechanical Systems

Heating: It is recommended that the dwelling be heated, but not cooled. The proposed heating system would adapt the 1949 passive heating distribution system for contemporary use. The system would be designed to meet the minimum requirements for limited use (primarily in the late evenings and early mornings at the beginning and end of the season). It is recommended, if electricity can be supplied from an outside utility source such as Grand Marais, that the structure be heated utilizing this electricity. However, if utility service is not available to sufficiently heat the Keeper's Dwelling (HS-09), a propane-operated heating unit could be located in the basement and vented, if necessary, through the east flue of the chimney, just as the historic furnace was. A new air distribution system could be installed in the location of the historic system, which could be accurately located through both historic drawings and physical evidence. If this is done, new metal grilles at the air supply, and return air openings, should be fabricated and installed to match the existing (historic) ones. This newly adapted system would provide sufficient heat and ventilation while, at the same time, creating the least amount of disturbance to the structure's historic fabric. Furthermore, additional insulation installed in the attic would increase the heat efficiency of the structure as well.

Condensation buildup within the cavity of the exterior walls appears to be the result of the lack of through-wall flashing and weep holes through which moisture can properly escape out of the structure without causing any damage. Condensation, which primarily accumulates during the spring within the cavity of the exterior brick walls, looks for ways to escape. It either moves toward the interior of the building, thereby causing plaster deterioration, or toward the exterior carrying the soluble salts from the mortar to the surface of the brick, causing unsightly efflorescence. The provision of heat and air circulation would alleviate the problem of the interior of the building becoming cooler than the exterior, which occurs primarily in the spring when the problem is at its worst. Therefore, it is recommended that the structure be heated to temperatures above freezing during the winter and spring months, in conjunction with a system which can provide a minimal amount of air circulation to distribute the heat uniformly throughout the structure. By keeping the exterior walls warmer, the condensation problems within the cavity of the exterior walls would be prevented or greatly reduced because the dew point would be moved outward, facilitating evaporation. Additional engineering would be required to sufficiently tie the minimal winter system together with the summer-occupancy system, and to provide a safe and efficient energy source during the winter.

It is important to note that even with the completion of this level of investigation of the structure, it is unclear,

without additional research, whether or not the heating and air circulation systems alone will entirely alleviate the condensation problem. Regardless, mitigation of the condensation should be approached in phases, with heating installation as the first phase. This treatment, if proven successful, would cause the least amount of destruction to the historic fabric of the building while deterring further deterioration of both the remaining historic fabric as well as the new interior and exterior fabric. However, if this does not entirely mitigate the condensation problem, an additional approach would be to create weep holes to the interior of the structure behind the baseboards, which would vent the cavity to the interior of the building. Although this alternative would provide a more direct means of letting the condensation escape from within the cavity wall, it would also alter a significant amount of the structure's historic fabric.

A final recommendation, which would be much more extensive, would be to provide through-wall flashing and weepholes (to the exterior) at all of the exterior walls above the water table. This step should only be undertaken if proper heating and air circulation systems do not work because it would create an extensive amount of irreversible destruction to the historic fabric of the structure. Additionally, this alternative would need to be thoroughly investigated prior to its initiation.

Water and Plumbing

The new hot water heater should be installed adjacent to the south face of the chimney, so that it can use the west flue of the chimney for ventilation. The original, 30 gallon water heater was previously located in this same location.

Sanitary System

There are two options for providing sufficient sanitary waste disposal for either one or two bathrooms in the Keeper's Dwelling (HS-09).

Option 1: This option involves the installation of either one or two composting toilets (based on the rehabilitation scheme that is chosen). This option is the least desirable, primarily due to the inconvenience, logistics, and health factors involved in emptying and transporting the waste outside, especially that which is generated at the second floor. Furthermore, several composting toilets, in use at other National Park Service facilities, have been removed due to these very problems.

Option 2: This option is the most desirable, as it involves the installation of either one or two (based on the rehabilitation scheme that is chosen) low volume flush toilets. Both toilets would be connected to an underground storage tank which would be periodically pumped by the National Park Service.

With either sanitary system, it is recommended that the new vent stack required for the toilet(s) be installed in the location as the current vent stack, to minimize the disturbance of the structure's historic fabric.

Electrical System

Lighting: Any new light fixtures and switches which are to be installed throughout the structure, should be installed in historic locations to the greatest extent possible. All of the existing remnants of fixtures, switches, and receptacles are assumed to be original to the structure, installed in 1944. Those that are sufficient to remain, should be completely rewired to current Underwriters Laboratories, Inc. standards and labeled accordingly.

Electricity: The validity of all existing conduit should be checked by a licensed professional. If it is acceptable then the conduit should be reused and entirely rewired to UL standards and labeled. Additional fixtures and /or receptacles should also be installed to bring the building up to current living standards, especially in such rooms as the kitchen(s) and the bathroom(s). The existing electrical service feeder leading into the building should be replaced by a new pipe and wire connection.

Security System: It is recommended that an intrusion detection system be installed with the least amount of destruction to the historic fabric as possible. This system would be utilized during the off-season, winter months. In conjunction, the access road to the site should be maintained to allow National Park Service personnel or other authorities to respond to the system within thirty minutes.

Fire Protection

In addition to the recommended fire suppression system, adequate smoke alarms should be installed, with consideration given to the preservation of the structure's historic fabric in the areas of the dwelling that are re-

habilitated as living quarters. In addition, a fire alarm system should be installed, in connection with a visitor intrusion alert system, which would be used in the off season months, and allow personnel the ability to reach the site within thirty minutes after being alerted.

Handicapped Accessibility

Handicapped accessibility would be more readily achievable and preferable at the south entrance of the Keeper's Dwelling (HS-09) than at the north entrance for two reasons. The vestibule that one immediately enters at the north entrance is not large enough to provide adequate turnaround clearance for a wheelchair. Second, the south entrance should be the main entrance into the structure due to its orientation toward the site's approach.

The provision of handicapped accessibility at the south entrance would entail the construction of a ramp along the west elevation of the dwelling, and the removal of the west porch wall to provide access to the porch from the terminus of the ramp. The ramp would need to be a switch-back type, with an intermediate landing. Furthermore, the 2" threshold at Door 104.2 would have to be removed and the porch height raised by adding a 3" depth of concrete to the porch slab, in order to make it flush with the first floor level of the structure (and, consequently with the water table at the exterior of the dwelling). Additionally, after the porch slab has been raised, the concrete stairs leading to the porch would have to be reconstructed, with one additional riser, and a handrail installed at each side of the stairs. The construction of this ramp and related features, if Concept A is chosen as the rehabilitation strategy and the first floor is utilized as a visitor contact facility, would allow all visitors to enter the structure through the same entrance while facilitating a more private entrance to the second floor residence at the north entrance of the structure. If the structure is divided into two residences, as proposed in Concept B, the handicapped accessible south entrance would provide access to the handicapped accessible first floor apartment, while maintaining a separate entry to the second floor residence at the north entrance.

At the interior of the first floor of the Keeper's Dwelling (HS-09), all of the doors are 32" in width. The clear width at handicapped accessible doorways is 32". In this situation, with the door being 32" wide, the door stops and the actual door itself, while in the open position, both impede upon the clear width of the opening. There are two alternatives for providing adequate clear width at the interior openings. The first entails removing the doors and the stops from each opening to provide 32" of width. This alternative would alter the historic appearance of the space, however. The second alternative would be to reconstruct each of the openings to provide sufficient clear width of at least 2' - 10". New wood-panel doors, frames, and casings would then need to be constructed to match those existing in the structure.

Interior Finish Treatment Recommendations

General Finish Treatments for the Entire Dwelling

It is recommended that all of the interior materials and finishes throughout the Keeper's Dwelling (HS-09) be restored (or replicated if missing) to their 1909 - 1910 appearance, where feasible. The approach this report takes is to retain as much of the historic fabric as possible throughout the entire structure. Where this is not achievable, due to the requirements of contemporary living quarters, it is recommended that historic precedent be followed wherever possible. An example would be the installation of both a new electrical system and a new heating system. Although these prevent areas of the structure from being restored to their 1909 -1910 appearance, they can be placed in their historic locations, which date to 1944 and 1949, respectively.

Some on-site determination as to the feasibility of either maintaining and restoring the existing fabric or replacing it with new in-kind, will likely be required at the time treatment takes place, particularly at severe areas of surface damage and deterioration. It is suggested that, in cases where it is not feasible to remove the historic fabric without destroying it altogether, and it does not present a safety or structural hazard and /or physically disturb those individuals occupying the structure, that the integrity of the material be maintained.

Existing Paint Surfaces: Prior to any physical treatment of the interior surfaces, all of the existing lead paint should be properly removed from the surfaces.

Interior Wood Surfaces: Interior wood surfaces include: window and door jambs and casings, windows and

doors, baseboard and shoe molding trim, and all wood components of the stairs. The majority of these interior wood surfaces throughout the dwelling are either painted or stained and varnished, with evidence of significant buildup. The buildup and incompatibility of the layers of different finishes, has created an "alligatored" pattern of cracking. It is recommended that all wood in this condition be stripped using chemical finish removers, and then refinished according to the paint analysis.

Further, the paint analysis revealed that the finish, at the wood surfaces throughout the structure, is relatively the same. It also revealed that the original (1909 - 1910) finish of the wood surfaces was stain and varnish, despite the results of physical investigation which revealed paint buildup at several of the wood surfaces.

Window Openings: The wood surfaces at most of the window stools, jambs, and casings throughout the structure, have extensively weathered, including some areas where the wood has split. These surfaces should be sanded smooth, and the cracks filled with a stainable wood filler. The level of deterioration at some of the window openings, however, does not allow them to be completely sanded smooth. In this situation, if the area that requires sanding can be feathered into the adjacent wood surface, and not be visually distracting, then the historic fabric should be retained. Furthermore, as part of a comprehensive restoration program, all of the window sashes should be removed from the structure and completely restored, including wood repair and / or replacement, refinishing, replacement of the glazing putty, and the replacement of all sash cords and other missing or broken hardware.

Wood Flooring: Prior to any physical treatment of any of the floor surfaces, the demarcations or ghosted images of all former floor coverings should be accurately documented for archival purposes. All flooring, especially in areas of buildup and failure, which have a historically natural (stain) finish, should be mechanically sanded to remove the finish. This should then be followed by the application of a water-based polyurethane finish. Although varnish is the historically correct finish, experience at other light stations (i.e. South Manitou Island Light Station, Sleeping Bear Dunes National Lakeshore) has shown modern polyurethanes to be more durable and less prone to "tackiness" once set.

Areas of flooring that historically have had a paint finish, should undergo paint preparation, including the mechanical sanding of uneven areas to remove paint buildup, and the feathering of these areas into the smooth, adjacent surfaces. The floors should then have new paint applied. Floor coverings, such as varnished canvas or linoleum, may then be installed in the rooms in their historically accurate locations, and in accordance with the adapted use plan.

Exterior Wall Surfaces: Due to the level of deterioration at all of the exterior walls, all of the plaster should be removed from the walls' surfaces. In addition to the condensation buildup within the cavity of the exterior walls, the plaster deterioration, caused by water infiltration, may also be accelerated by water entering at window and door openings. Following plaster removal, all of the openings should be further investigated, and, if necessary, be properly sealed and associated deteriorated mortar joints tuckpointed. Furthermore, if areas of rotten wood nailers (for casing and trim attachment) appear at the window openings, the rotten wood should be removed and new wood installed. Following the prescribed treatment(s) to mitigate the condensation problem at the exterior wall cavities (which appears to be taking place during the spring months), new plaster should be directly applied to the brick surfaces. This method will alleviate any problems with plaster thickness, and the matching of existing window and door trim throughout the structure.

Interior (partition) Wall Surfaces: At all of the interior walls, where plaster repair is required, the minimal amount of plaster should be removed. The plasterboard lath should also be removed in areas where the plaster has been removed. The open area should then be fitted with wire lath, and new plaster installed and feathered into the adjacent, sound plaster surfaces. Finally, a new skim coat should be applied to the entire wall surface.

Specific Room Recommendations

First Floor

Room 101 - Parlor or Living Room: Following exterior repairs to stop water infiltration, the damaged areas of plaster at the chimney, as well as areas of plaster damage at the ceiling near the chimney, should be patched and repaired. In addition, the area of missing plaster at the south wall caused by the removal of the air duct, should be patched and repaired. All deteriorated plaster at the north and east exterior walls should be

removed and, following repairs to stop water condensation at the cavity walls, new plaster installed. New baseboard trim, which matches the existing trim, should be installed at areas of the room where it is currently missing, including portions of the south wall and the entire north wall. Following the completion of all of the repairs, all wood and plaster surfaces should be refinished according to the paint analysis.

If Concept B is chosen as the rehabilitation treatment for the Keeper's Dwelling (HS-09), several additional treatments need to be undertaken prior to those listed above. The entire west wall should be removed, including Door #101.1, to allow for the installation of the bathroom. Following the demolition of the wall, the adjacent surfaces at the north and south walls should be patched and repaired. New stud walls, as shown on the Concept B Drawing, should then be constructed. Door 101.1 should be relocated to the new east wall of the bathroom. The proportions and layout of fixtures of this bathroom, including the prefabricated shower unit, sink, and toilet, provide handicapped accessibility, and should be followed.

Room 101A - Closet: If either Option A or C are chosen as the rehabilitation strategy for the structure, the diagonal shaft wall at the northwest corner of the closet should remain and be utilized to enclose the plumbing fixtures required for the bathroom located at the second floor. Furthermore, the areas of cracked plaster should be patched and repaired. The wood hook rail and metal coat hooks should remain in place and be repaired and refinished as necessary.

If Concept B is chosen as the rehabilitation strategy for the structure, the entire closet should be removed, including the shaft wall. The space will then be incorporated into the bathroom, as previously described in the treatments for Room 101.

Room 102 - Dining Room: All deteriorated plaster at the east and south exterior walls should be removed and, following repairs to stop water condensation at the cavity walls, new plaster installed. The deteriorated wood baseboard trim along the east and south walls should be removed and new trim, which matches the existing, installed. Furthermore, a new picture rail should be installed in the location of the historic one, as denoted by the demarcations in the wall surfaces. Following all repairs, all of the wood and plaster surfaces in the room should be refinished according to the paint analysis.

Room 103 - Pantry: The existing vent stack along the west wall should be removed. However, if either Concept B or C is chosen as the rehabilitation strategy for the structure, the new vent stack required for the adjacent kitchen sink, should be installed in the same location. The vertical plaster cracks at the exterior corners of the room should be repaired. Following all repairs, all wood and plaster surfaces should be refinished according to the paint analysis.

Room 104 - Kitchen: The area of missing flooring at the southwest corner of the room should be patched with tongue-and-groove boards which match the existing ones. Additionally, the floor boards near Door #104.2 that have extensively weathered (cupping), should also be replaced for visitor safety. All deteriorated plaster at the west and south exterior walls should removed, and, following repairs to stop the water condensation at the cavity walls, new plaster installed.

As one factor of restoring the first floor to its 1909 - 1910 appearance, as much as possible regardless of which rehabilitation concept is chosen, both the original east wall, and the built-in cupboard adjacent to the chimney at the northeast corner of the room, should be reconstructed. The rebuilding of this opening allows the opportunity for it to provide sufficient clearance for handicapped accessibility if either Concept A or B. The area of missing plaster at the north wall, due to the removal of an air duct, and the area of damaged plaster at the east wall, due to the removal of cabinets, should both be patched and repaired. Following exterior repairs to mitigate water infiltration, the areas of deteriorated plaster at the chimney should be patched and repaired.

A new baseboard trim and shoe molding, which match the existing ones, should be installed at the areas of the room where they are currently missing. Further, a new wood casing should be installed at Door #104.2, where it is currently missing. When all of the repairs have been completed, all of the wood and plaster surfaces in the room should be refinished according to the paint analysis.

If either Concept B or C is chosen as the rehabilitation strategy for this structure, the kitchen should be entirely updated, meeting all of the code requirements

for a contemporary kitchen. The installation of new fixtures should include: wood base and wall cabinets (as denoted on the Concept drawings), a sink, a refrigerator, and a stove /oven. Careful attention should be paid to keeping intervention /damage of the historic fabric to a minimum. Both the oven and the refrigerator will be propane-gas operated.

Room 105 - Central Hall: Due to the extensive amount of oxidation, the metal floor grille at the southeast corner of the room should be replaced. The water damage at all of the walls, with the exception of the deep horizontal crack which extends along the south wall, appears to be only surface damage, and therefore plaster removal is not required. However, the plaster surfaces should be patched and repaired and a new skim coat applied. Following the completion of all repairs, all of the wood (including the entire staircase and the turned wood corner bead) and the plaster surfaces should be refinished according to the paint analysis.

Room 106 - Entry Vestibule: New ceiling plaster, including lath, should be installed at the area of the ceiling where it is currently missing. Furthermore, all of the deteriorated plaster at the north exterior wall should be removed and, following repairs to stop water condensation at the cavity wall, new plaster installed. New wood baseboard trim and shoe molding should be installed at the areas of the room where the existing ones have deteriorated and /or are rotten. Following the completion of all repairs, all wood (including the wood shelves at the east wall) and plaster surfaces should be refinished according to the paint analysis.

Second Floor

Room 201 - Northeast Bedroom: Prior to refinishing the floor, the circular demarcations in the floor finish (of unknown origin) should be documented for archival records and possible future investigation. Following exterior repairs to mitigate water infiltration, the areas of deteriorated plaster at the chimney, including the vertical settlement cracks, should be patched and repaired. Furthermore, all of the deteriorated plaster at the north and east exterior walls should be removed and, following repairs to stop water condensation at the cavity walls, new plaster installed. New wood baseboard trim and shoe molding should be installed at the areas of the room where the existing ones have deteriorated and /or are rotten. Following the completion of all of the repairs, all wood (including the turned wood corner bead at the chimney) and plaster surfaces should be refinished according to the paint analysis.

Room 201A - Closet: The non-historic shaft partition wall, at the north end of the closet, should remain and be utilized to enclose the plumbing lines required for the adjacent bathroom. The areas of minor plaster damage at the wall and ceiling surfaces should be patched and repaired, and a new skim coat applied, if necessary. The wood hook rail and metal hooks should remain in place, and be repaired and/or refinished as necessary.

Room 202 - Southeast Bedroom: All of the deteriorated plaster at the south and east exterior walls should be removed and, following repairs to stop water condensation at the cavity walls, new plaster installed. New wood baseboard trim and shoe molding should be installed at the areas of the room where the existing ones have deteriorated and /or are rotten. Furthermore, a new picture rail should be installed at the location of the historic one, as denoted by the demarcations in the wall surfaces. A new turned wood corner bead, to match the existing ones in the structure, should be installed at the chimney. Following the completion of all repairs, all wood and plaster surfaces should be refinished according to the paint analysis.

Room 202A - Closet: The existing vent stack along the west wall should be removed. However, regardless of whether Concept A, B, or C is chosen, a new vent stack is required, and it should be installed in the same location as the existing one. The vertical settlement cracks at the exterior corners of the closet should be patched and repaired. Furthermore, the wood hook rail and the metal coat hooks should remain. If they intrude on the rehabilitated use of the closet (pantry in Concept A), they should be properly stored as artifacts.

Room 203 - Southwest Bedroom: All of the areas of damaged plaster, including the horizontal cracks at the north, south, and west walls, and the vertical settlement crack at the northwest corner of the room, should be patched and repaired, followed by the application of a new skim coat. A new turned wood corner bead, to match the existing ones in the structure, should be installed at the chimney. The loose wood baseboard trim should be properly reattached to the west wall of the room. Following the completion of all repairs, all wood and plaster surfaces should be refinished according to the paint analysis.

Room 203A - Closet: The vertical settlement cracks at the exterior corners of the closet should be patched and repaired. Furthermore, the wood hook rail and the metal coat hooks should remain in place, and be repaired and refinished as necessary.

Room 204 - Hall: Prior to refinishing the floor, the circular demarcations (of unknown origin) should be documented for archival records and possible future investigation. Following exterior repairs to mitigate water infiltration, the areas of deteriorated plaster at the chimney and at the ceiling near the chimney, including the vertical settlement cracks, should be patched and repaired. All of the deteriorated plaster at the west exterior wall (alongside the stair to the first floor) should be removed and, following repairs to stop water condensation at the cavity walls, new plaster installed. Upon the completion of all of the repairs, all wood (including the turned wood corner bead and the recessed niche and ship's ladder leading to the attic) and plaster surfaces should be refinished according to the paint analysis.

Room 205 - Bathroom: The existing bathtub, and any other plumbing remnants that remain, should be removed from the room. All of the deteriorated plaster at the north exterior wall should be removed and, following repairs to stop water condensation at the cavity walls, new plaster installed. The areas of plaster damage at the ceiling should be patched and repaired. New fixtures should be installed, including: a prefabricated shower unit, a sink with an attached base cabinet, and a toilet. Following the installation of the plumbing fixtures, the floor boards should be patched and repaired, as necessary. Upon the completion of all of the repairs, all wood and plaster surfaces should be refinished according to the paint analysis.

Tower (HS-10)

Exterior

The exterior masonry surfaces at the Tower should continue to be properly maintained to prevent paint buildup. Additionally, the failing paint at the masonry surface above the exterior gallery (the lantern base), should be scraped to a sound surface, and new black paint applied according to the findings of the paint analysis. Furthermore, additional investigation of the paint analysis and historic photographs should be undertaken to determine whether or not the trim of the round top windows and the horizontal bands of raised brick, which extend around the tower at the watchroom level, were historically painted gray (rather than their current black) during the period of interpretation (1909 - 1910). The exterior metal surfaces should be scraped to either bare metal or a sound paint surface and sanded, and new black paint applied according to the paint analysis.

Interior

The area of cracking and deteriorated plaster at each of the windows at the watchroom level of the tower, especially at the east window, should be patched and repaired. The missing hardware at the built-in wood cabinet should be replaced, and further investigation of the paint analysis conducted, to accurately determine its historical color, so that it can be repainted in that color. Following the completion of all repairs, all of the wood (including the built-in cabinet) and the plaster surfaces should be refinished according to the paint analysis.

At the lantern room, the areas of rust at the metal surfaces, including the hatch door in the floor and its frame, should be scraped, have a rust-inhibitive primer applied, and be painted according to the paint analysis. The areas of damaged and /or deteriorated wood at the wainscot should be replaced and repaired. Following all repairs, all of the wood, metal, and plaster surfaces should be refinished according to the paint analysis.

Double Keepers' Duplex Residence (HS-11)

General Approach Toward Recommendations

Extensive restorative treatment has already been initiated by the National Park Service at both the exterior and the interior of the Double Keepers' Duplex Residence (HS-11). The Park Service's goal is to restore the entire structure to its 1909 - 1910 appearance. Restoration treatments will continue to focus on that period of time, as accurately as existing information permits. Modern systems, required for visitor comfort and safety, will be introduced only as necessary and in visually non-obtrusive locations. The dwelling will ultimately serve as an interpretive museum focusing on life at the Au Sable Light Station immediately following its major 1909 -1910 upgrading.

Building Exterior

Roof: The same two alternative approaches for the treatment of the roof of the Keeper's Dwelling (HS-09) can be applied to the roof at the Double Keepers' Duplex Residence (HS-11). Furthermore, there are two areas of the roof at the Double Keepers' Duplex Residence (HS-11) which are the former locations of the vent stacks. These vent stacks were removed by the National Park Service in 1990, however, the roofing system was not properly patched. As part of either roof treatment alternative, new sheathing should be installed in these areas and properly sealed to prevent further water infiltration, which has already extensively taken place.

Gutters: As part of a comprehensive restoration program, new gutters should be installed at the north and south elevations of the building in their respective historic locations, as determined from both historic drawings and photographs.

Exterior Brick Surfaces: The area of deteriorated mortar joints below Window 1-3 should be tuckpointed to mitigate the extensive amount of water infiltration at this location. Furthermore, the entire exterior of the structure should be re-investigated to determine if there are any other areas of the brick surface that require tuckpointing.

Exterior Wood Surfaces: The areas of deteriorated wood at the east porch, since they are non-historic, should replaced and refinished, especially those at the southeast column.

Building Systems

Structural System

Based upon physical investigation (very few knots and clear, straight grain were observed) and historical precedent (the extant Split Rock lighthouse specifications call for white pine, "free of the usual defects"), a select structural white pine, with a stress value of 1400 psi, was used to determine the current live load limits of the Double Keepers' Duplex Residence (HS-11). The tables used to calculate the load limits are included in Appendix A. All of the load limit calculations assume that there will be no attic live load and that all of the joists with holes, due to previous mechanical equipment, would be restored with gussets to their original capacity.

Currently, live load is limited at the first floor at the east (1909) portion of the structure. In this area, (Rooms 101 and 110), the superimposed load limit is 40 psf, which is limited by shear at the 8" x 12" wood beam. In the central portion of the structure, (Rooms 102 and 108), the current superimposed load limit is 130 psf. At the west end of the structure, (Rooms 103, 105, and 107), the superimposed load limit is 75 psf, and is limited by both bending and shear stress.

Live load is also limited at the second floor at the east (1909) end of the structure. In this area, (Rooms 201 and 213), the superimposed load limit is 30 psf. At Rooms 203 and 210, the superimposed load limit is a much higher 120 psf. However, at the west end of the structure (Rooms 205, 208, and 209), the superimposed load limit is 30 psf, which is limited by both bending and shear stress.

The required live load minimum, based upon an assembly occupancy in the Double Keepers' Duplex Residence (HS-11), which would serve as an interpretive museum to park visitors, is 100 psf. Based on the current superimposed load limits, the required 100 psf exists only in Rooms 102 and 108 at the first floor, and in Rooms 203 and 210 at the second floor. However, at the west area of the structure, (Rooms 103, 105, and 107 at the first floor and Rooms 205, 208, and 209 at the second floor), the live load can be increased to 100 psf by adding shores at each side of the center masonry wall in the basement. These shores should be located below the stair walls above, and the system should extend at least 14 feet from the west basement wall. At the east (1909) end of the structure, the superimposed load limit can be increased from 40 psf at the first floor and 30 psf at the second floor, to 100 psf at both floors. This can be accomplished by adding a beam and post shore in the east-west direction to the first floor structure, approximately 2' - 6" north of the existing beam. This location should align the beam with the stair wall above.

Mechanical System

Heating: It is recommended that the Double Keepers' Duplex Residence (HS-11) be heated and ventilated, but not cooled. The proposed heating system would adapt the original heating system for contemporary use. The system would be designed to meet the minimum requirements for limited system use (primarily in the late evenings and early mornings during the early and late parts of the season, if at all), since the structure will be presumably occupied by museum artifacts and

visitors only during the months of late May through October. Otherwise, all utilities, including the heating system, will be completely shut down during the winter months.

To sufficiently heat the structure for artifact exhibition and visitor use, a propane-operated heating unit would be located in the basement of the dwelling. Heat would then be distributed through the chimney and the historic stovepipe openings, which would be reopened and adapted for heat flow into the individual rooms at the first and second floors. This adaptive system would provide sufficient heat and ventilation for visitors and artifacts alike, while, at the same time, creating the least amount of disturbance to the historic fabric of the structure, and allowing for a more accurate presentation of the structure as it appeared in 1909 -1910.

Electrical System

Lighting: To create the least amount of disturbance to the structure's historic fabric, and to accurately represent the structure's 1909 -1910 appearance, natural daylight should be utilized to the greatest extent possible. Minimal lighting should be installed to ensure visitor safety, and the light fixtures and switches should be installed in visually non-obtrusive locations.

Electricity: New electrical conduit and receptacles, which should be installed according to UL standards and properly labeled, should be kept to a minimum throughout the structure. This new electrical equipment should be limited to only that which is required to ensure visitor comfort and safety.

Security System: It is recommended that an intrusion alarm system be installed with the least amount of destruction to the historic fabric as possible. This system, in addition to the system at the Keeper's Dwelling (HS-09), would be utilized during the off-season, winter months. In conjunction with the systems, the access road to the site should be maintained to allow National Park Service personnel or other authorities the ability to respond to the systems within thirty minutes.

Fire Protection

A fire alarm system should be installed in connection with an intrusion alarm system, which would be used in the off-season months. In conjunction with these systems, the access road to the site should be maintained to allow National Park Service personnel or other authorities the ability to respond to the systems within thirty minutes.

Handicapped Accessibility

Handicapped accessibility into the Double Keepers' Duplex Residence (HS-11) can be achieved at the east porch entrances into the building, through the construction of an exterior ramp to the porch. Furthermore, either a small ramp will need to be installed to provide access between the porch deck and the first floor level of the structure, or the entire porch should be raised to be flush with the first level. Once inside the building, handicapped accessibility is readily achievable throughout the first floor. However, as previously mentioned, accessibility to the second floor is not practical or readily achievable.

Interior Finish Treatment Recommendations Specific Room Recommendations

First Floor

Room 101 - Entry: Following repairs at the roof (at the improperly sealed opening in the roof sheathing from the former vent stack) to mitigate the current water infiltration, the deteriorated areas of plaster along the north and east walls, and the northeast corner of the ceiling, should be patched and repaired.

Room 102 - Living Room: Following the reopening of the stovepipe thimble (as part of the contemporary heating system installation), the adjacent plaster should be patched and repaired as necessary. If possible, a picture molding to match the original should be installed in its historic location around the entire perimeter of the room. The molding profile may be determined by the study of extant picture moldings in the building, a comparison with molding found in other light stations of the period, or a study of period practices.

Rooms 103 - Bedroom: A picture molding to match the original should be installed in its historic location around the entire perimeter of the room.

Rooms 104, 105, 106, 107, 109, and 111 need no further treatments at this time.

Room 108 - Dining Room: Following the reopening of the stovepipe thimble (as part of the contemporary heat-

ing system installation), the adjacent plaster should be patched and repaired as necessary.

Room 110 - Kitchen: Following the reopening of the stovepipe thimble (as part of the contemporary heating system installation), the adjacent plaster should be patched and repaired as necessary.

Room 112 - Entry Vestibule and Stair to Basement: Following the completion of tuckpointing at the exterior of the building to stop the current water infiltration, especially beneath Window 1-3, the deteriorated areas of plaster at the south wall should be patched and repaired.

Second Floor

Room 201- Kitchen: Following repairs at the roof (at the improperly sealed opening in the roof sheathing from the former vent stack) to mitigate the current water infiltration, the deteriorated areas of plaster along the north and east walls, and the northeast corner of the ceiling, should be patched and repaired. Furthermore, following the reopening of the stovepipe thimble (as part of the contemporary heating system installation), the adjacent plaster should be patched and repaired as necessary.

Room 203 - Bedroom: Following the reopening of the stovepipe thimble (as part of the contemporary heating system installation), the adjacent plaster should be patched and repaired as necessary. Additionally, a custom profile (to match the original) picture molding should be installed in its historic location around the entire perimeter of the room.

Room 209 - Bedroom: Following repairs at the roof (at the improperly sealed opening in the roof sheathing from the former vent stack) to mitigate the current water infiltration, the deteriorated areas of plaster along the south wall, and at the ceiling, should be patched and repaired.

Rooms 202, 204, 205, 206, 208, 210, and 211 require no further treatments at this time.

Room 213 - Dining Room: Following exterior repairs (tuckpointing) to mitigate the current water infiltration, the deteriorated areas of plaster along the east wall, should be patched and repaired. In addition, following the reopening of the stovepipe thimble (as part of the contemporary heating system installation), the adjacent plaster should be patched and repaired as necessary.

Attached Passageway

Exterior Finish Treatment Recommendations

Roof: The same two alternative approaches for the treatment of the roof at the Keeper's Dwelling (HS-09) and at the Double Keepers' Duplex Residence (HS-11), apply to the roof of the attached Passageway.

Exterior Brick Surfaces: The white line of paint located at both the north and the south elevations, should remain, due to its historical significance in relation to the complex. The lichen, which is growing on the brick surfaces at the south elevation, should be removed with water and a stiff natural bristle brush, after soaking. Following its removal, if stains are observed on the masonry surfaces, they should be removed with carefully chosen organic solvents. Furthermore, as part of a comprehensive restoration program, a chemical agent should be applied to the masonry surface to prevent future organic growth.

Interior Finish Treatment Recommendations

Walls: The area of the exposed wall system at the east wall should be maintained and interpreted.

Recommendations for Treatments at the Fog Signal Building (HS-16)

The ultimate treatment for the Fog Signal Building (HS-16), as well as for the other buildings at the Au Sable Light Station, as stated in the Pictured Rocks National Lakeshore's General Management Plan, is to minimally restore the exterior of the structure to the historic period of 1909 - 1910, and to interpret the building as it existed during that historic period. However, there were two entirely distinct sets of fog signal apparatuses in place, both of equal historical significance, in the Fog Signal Building (HS-16) throughout its operation from 1897 through 1958. Both sets of equipment cannot be adequately displayed and interpreted in their entirety in the building at the same time. Further, several distinct architectural alterations were undertaken at the structure in 1928 to accommodate the new fog signal system at that time, which remain extant. By restoring and interpreting the structure to the historic period of

1909 - 1910, these extant features would either have to be removed or "explained away" to visitors, an undesirable interpretative approach.

Therefore, all of the current intact features of the structure should be restored, including the structural reinforcement added in the early 20th century, and the dormer added to supplement the air diaphone system in 1928. As stated in No. 4 of the Secretary of the Interior's Standards for Rehabilitation, "Changes which may have taken place in the course of time are evidence of the history and development of a building, structure, or site and its environment. These changes may have acquired significance in their own right, and this significance shall be recognized and respected."[7]

It is recommended that both the exterior and interior of the Fog Signal Building (HS-16) be preserved in its current configuration, and the entire history of the structure be interpreted. The building's history and importance to the lighthouse complex can be interpreted through both the restoration of the structure itself, and through the addition of exhibits which represent those aspects of the building that are no longer extant (such as the fog signal apparatuses). The role of technology at the lighthouse complex, and the importance that the Fog Signal Building (HS-16) played in utilizing that technology, are a significant part of the history of the Au Sable Light Station.

Exterior Treatments

Roof: The existing asphalt shingles should be removed from the roof and properly disposed of away from the site. Following their removal, any areas of deteriorated sheathing should be removed and new wood sheathing installed. Further, either the existing historic pressed metal shingles (if their condition permits) or new pressed metal shingles should be installed. A rust-inhibitive primer should be applied to the shingles, followed by paint chosen according to historic documentation or a future paint analysis.

Exterior Wood Surfaces: All of the exterior wood surfaces of the structure should be restored, including the window frames, doors, eaves, and wood surfaces of the dormer. Treatment should include the removal of paint down to the bare wood, sound paint, or primer. If either the primer or sound paint is left on the surface, the edges should be sanded smooth and feathered to the adjacent bare wood surface. A primer coat should then be applied, followed by finish coats, with colors chosen according to historic precedent. (As part of a comprehensive, restoration program, a complete paint analysis should be undertaken at this structure.) Additionally, all missing door and window hardware should be replaced.

Interior Treatments

To allow safe visitor interpretation of the Fog Signal Building (HS-16), all equipment and other debris should be removed from the structure. If any of this material is to be retained by the National Park Service, it should be relocated to one of the unoccupied outbuildings or another facility. All of the interior metal surfaces, including the platform, ladder, and ceiling panels, should be scraped to either the bare metal or a sound surface, and then a rust-inhibitive primer applied, and the surfaces refinished. All of the interior concrete and masonry surfaces should be cleaned and painted, with colors chosen according to historic documentation. The failed mortar joints should also be repaired at the brick jack arches which support each of the door openings. All of the existing furnishings (such as the air tank) should remain in the Fog Signal Building (HS-16) and be incorporated into the interpretation program at the structure.

Brick Oil House (HS-13)

In accordance with the restoration of the exterior of all of the buildings at the complex to the historic period of 1909 - 1910, minimal treatment is required at the Brick Oil House (HS-13). However, selective tuckpointing should be undertaken at areas of mortar deterioration, including the lower east corner of the north elevation. Care should also be taken to use a mortar that is compatible in color and joint size with the existing mortar. The mitered metal corners of the cornice, which are pulling apart, should be sealed. All of the paint should be scraped from the metal door, either to the bare metal or to a sound surface, and feathered to the adjacent metal. This paint removal should be immediately followed by the application of a rust inhibitive primer and finish paint.

As part of a comprehensive restoration program, access into the structure should be regained by removing the plywood from the door opening. Based on future investigation, the interior could be interpreted to visitors, used as a storage facility for the National Park

Service, or to house the battery bank system required for the storage of electricity at the complex.

Metal Oil House (HS-12)

Further investigation should be undertaken to determine the color of this structure during the historic period of 1909 - 1910. Following investigation, the existing paint should be removed by scraping it down to the bare metal or to a sound surface, and a rust-inhibitive primer and finish coats applied.

As part of a comprehensive restoration program, access into the structure should be regained by removing the plywood from the door opening. Based on future investigation, the interior could be interpreted to visitors, used as a storage facility for the National Park Service, or to house the battery bank system required for the storage of electricity at the complex.

Privy # 1 (HS-14)

There are some minor areas of mortar deterioration where tuckpointing is recommended as part of a comprehensive preservation treatment of the structure. Areas of deteriorated wood at the eaves and cornices, including the mitered corner joints, should either be consolidated or replaced, and refinished. A new wood cleanout cover should be constructed at the east elevation.

As part of a comprehensive restoration program, the plywood should be removed from the door opening to determine the condition of the door, and its required restoration treatment.

Privy # 2 (HS-15)

The wood vent appears too deteriorated for consolidation, therefore, it should be removed from the structure and a duplicate vent fabricated and installed in the same location. Areas of the deteriorated wood cornice should be consolidated where possible, and repaired where they are not. Consolidation or replacement should be followed by refinishing. A new wood cleanout cover should be constructed at the east elevation. Furthermore, based upon additional investigation, some tuckpointing may be required at the cleanout.

As part of a comprehensive restoration program, the plywood should be removed from the door opening to determine the condition of the door, and its required restoration treatment.

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1 U.S. Department of the Interior, National Park Service, Cultural Resources, Preservation Assistance. *The Secretary of the Interior's Standards for the Treatment of Historic Properties 1992.* (Washington, D.C.: U.S. Government Printing Office, 1992), 1.

2 Enviroscience, Inc., V-11.

3 U.S. Department of the Interior, National Park Service. Management Policies (Washington, D.C.: U.S. Government Printing Office, Dec. 1988), chapter 5, p.14.

4 Ibid, 14.

5 U. S. Department of the Interior, National Park Service. *The Secretary of the Interior's Standards for Rehabilitation and Guidelines for Rehabilitating Historic Buildings.* (Washington, D.C.: U.S. Government Printing Office, 1983), 6.

6 Ibid.

7 Ibid.

Part H:
Research Recommendations

Part H: Research Recommendations

The opportunity to understand more about the chronology of the development of the Au Sable Light Station exists. In terms of archeological investigation, Bruce A. Jones provides the following incentives for future undertakings:

> In terms of the features at Au Sable which are no longer visible, the privy foundation and shed floor are either still in excellent condition or are still clearly discernible for further study. However, several features at the site remain to be identified and evaluated. These minimally include one or more frame sheds illustrated east of HS-11 in 1884 and 1891 photographs, a "hennery" or presumed henhouse which is illustrated south of HS-10 on the 1909 Tinkham map, and the several trash deposits and possible structural remains identified by Marie [Audrie R. Marie of the Midwest Archeological Center] at Au Sable in 1975. It is also possible that further work in the area south of HS-9 might still reveal the remains of the structure which also appears on the 1909 map and is illustrated in the 1920 photograph of the site.[1]

Jones concluded by saying that:

> In summary, the 1990 investigations have demonstrated that many of the subsurface historic resources at Au Sable Light Station are intact and that a considerable quantity of previously unknown features and information remain there to be addressed. The potential for disturbance and /or loss of this information base should be routinely addressed and carefully considered in the course of whatever ground-disturbing activities will be necessary for the development of the Au Sable facility.[2]

In addition to the potential for further understanding of the site through archeological investigation, there are several other areas in which further investigation should take place. Although a paint analysis was undertaken at the Keeper's Dwelling (HS-09), the Double Keepers' Duplex Residence (HS-11), and the Tower (HS-10), one was not undertaken at the Fog Signal Building (HS-16). It is recommended that one be conducted at this structure prior to any restoration treatments by the National Park Service.

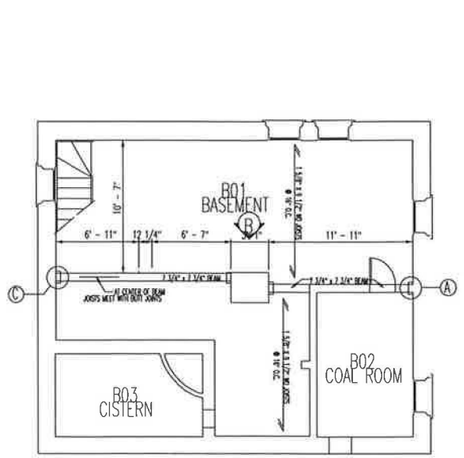
1 Bruce A. Jones, *Evaluative Investigations at the Au Sable Light Station, Pictured Rocks National Lakeshore, Michigan, 1990.* Prepared for the U.S. Department of the Interior, National Park Service, Midwest Archeological Center (Lincoln, NE: 1994), 23.

2 Ibid., 24.

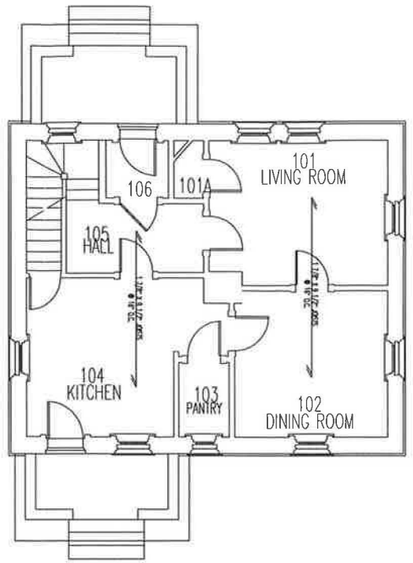
Part I:
Preliminary Design

Part I: Preliminary Design

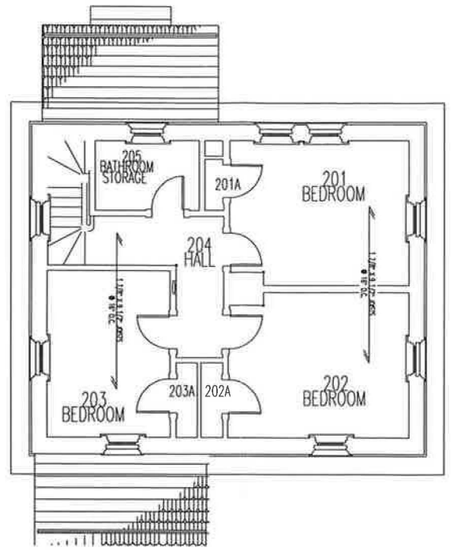
These comprehensive preliminary design drawings are provided following the determination of the rehabilitation treatment strategy of the Pictured Rocks National Lakeshore and the Midwest Regional Office of the National Park Service.



BASEMENT STRUCTURAL PLAN
Keeper's Dwelling HS-09: Existing Conditions

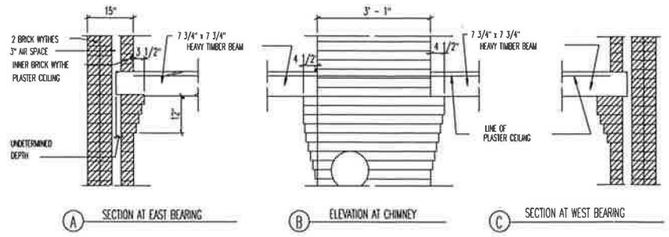


FIRST FLR STRUCTURAL PLAN
Keeper's Dwelling HS-09: Existing Conditions



SECOND FLR STRUCTURAL PLAN
Keeper's Dwelling HS-09: Existing Conditions

STRUCTURAL DETAILS
SCALE: 3/4" = 1'-0"



SCALE: 1/4" = 1'-0"

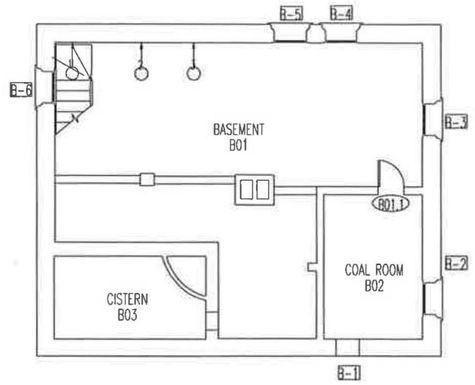
DOOR SCHEDULE

DOOR NO.	HEIGHT	WIDTH	THICKNESS	STYLE	CONDITION
B01.1					
101.1	83 - 1/2"	32"	1 -3/4"		
101.2	83 - 1/2"	32"	1 -1/4"	MISSING	ALL HARDWARE MISSING.
101.3	83 - 1/2"	32"	1 -1/4"	MISSING	
102.1	83 - 1/2"	32"	1 -1/4"	B	DOORKNOB MISSING, RM 102 SIDE..
104.1	83 - 1/2"	32"	1 -1/4"	B	ALL HARDWARE IS MISSING.
104.2	83 - 1/2"	32"	1 -1/4"	A	NON-ORIGINAL BRASS HARDWARE.
104.3	83 - 1/2"	32"	1 -1/4"		BOTH DOOR KNOBS MISSING; ALL REMAINING HARDWARE IS RUSTED.
105.1	83 - 1/2"	32"	1 -1/4"	B	
105.2	84"	36"	1 -3/4"	MISSING	
106.1	83 - 1/2"	32"	1 -1/4"	A	
201.1	79 -1/2"	32"	1 -1/4"		
201.2	79 -1/2"	32"	1 -1/4"		
202.1	79 -1/2"	32"	1 -1/4"		
202.2	79 -1/2"	32"	1 -1/4"		
203.1	79 -1/2"	32"	1 -1/4"		
203.2	79 -1/2"	32"	1 -1/4"	A	
205.1	79 -1/2"	32"	1 -1/4"		BOTH DOOR KNOBS MISSING; ALL REMAINING HARDWARE IS RUSTED.

DOOR STYLES

BASEMENT NOTE KEY

1. SPALLED, DETERIORATING PLASTER ABOVE GRADE, ENTIRE WALL.
2. PAINT FAILURE AT BRICK BELOW GRADE, ENTIRE WALL.
3. LOOSE, MISSING MORTAR ALONG BOTTOM OF NORTH WALL.

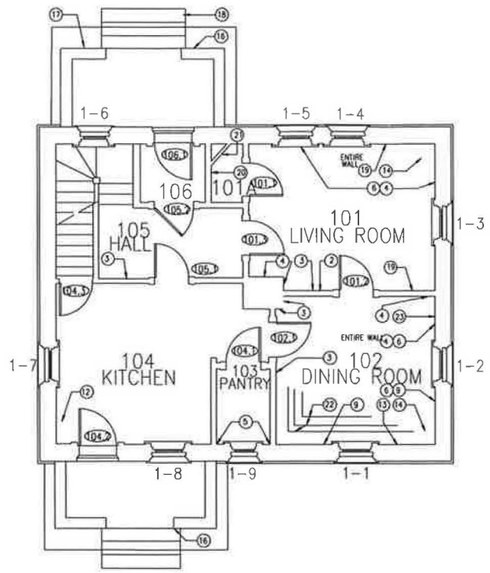


BASEMENT FLOOR PLAN
Keeper's Dwelling HS-09: Existing Conditions

4 0 4 8
SCALE: 1/4" = 1'-0"

FIRST FLOOR NOTE KEY

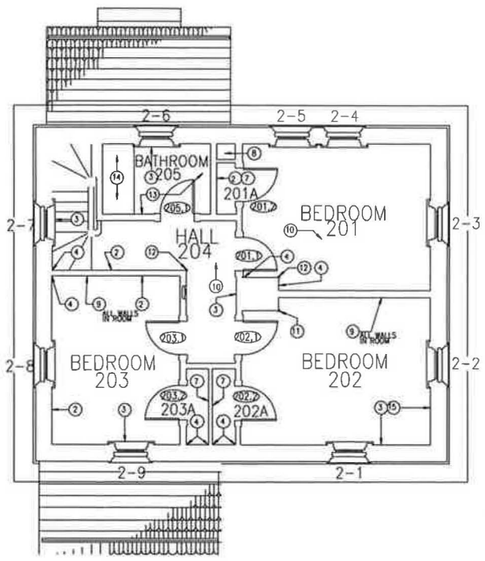
1. STRESS CRACK IN CEILING PLASTER.
2. SURFACE HAIRLINE CRACKS.
3. STRESS CRACKS IN WALL PLASTER.
4. SPALLING, DETERIORATED PLASTER.
5. FULL HEIGHT VERTICAL SETTLEMENT CRACK IN PLASTER.
6. MISSING PLASTER.
7. PLASTER LOOSE FROM SUBSTRATE.
8. TURNED WOOD DOOR STOP AT BASEBOARD IS MISSING.
9. WOOD ROT AT BASEBOARD.
10. BASEBOARD LOOSE / SEPARATED FROM WALL.
11. DAMAGED FLOOR BOARDS.
12. MISSING FLOOR BOARDS.
13. OPENING IN BASEBOARD FROM FORMER HEAT SUPPLY GRILLE
14. OPENING IN FLOOR FROM FORMER RETURN AIR GRILLE.
15. DETERIORATED MORTAR JOINTS.
16. LOOSE AND MISSING MORTAR.
17. SPALLING BRICK.
18. CRACKED / MISSING CONCRETE.
19. WOOD BASEBOARD MISSING.
20. WOOD HOOK RAIL WITH ORIGINAL METAL COAT HOOKS.
21. NON-ORIGINAL PLUMBING SHAFT.
22. DEMARCATION ON FLOOR BOARDS FROM FORMER FLOOR COVERING.
23. DEMARCATION ON PAINT SURFACE INDICATING PREVIOUS LOCATION OF PICTURE MOLDING.



FIRST FLOOR PLAN
Keeper's Dwelling HS-09: Existing Conditions

SECOND FLOOR NOTE KEY

1. STRESS CRACK IN CEILING PLASTER.
2. STRESS CRACKS IN WALL PLASTER.
3. SPALLING, DETERIORATED PLASTER.
4. FULL HEIGHT VERTICAL SETTLEMENT CRACK IN PLASTER.
5. BASEBOARD LOOSE / SEPARATED FROM WALL.
6. OPENING IN BASEBOARD FROM FORMER HEAT SUPPLY GRILLE
7. WOOD HOOK RAIL WITH ORIGINAL METAL COAT HOOKS.
8. NON-ORIGINAL PLUMBING SHAFT.
9. DEMARCATION ON PAINT SURFACE INDICATING PREVIOUS LOCATION OF PICTURE MOLDING.
10. CIRCULAR DEMARCATIONS IN FLOOR BOARDS OF UNKNOWN ORIGIN.
11. DEMARCATION IN PAINT SURFACE INDICATING FORMER LOCTION OF TURNED WOOD CORNER BEAD.
12. TURNED WOOD CORNER BEAD.
13. EVIDENCE IN FLOOR BOARDS AND WALLS, INCLUDING STAINS AND HOLES, FROM FORMER BATHROOM FIXTURES.
14. BATHTUB.
15. PLASTER LOOSE FROM SUBSTRATE.



SECOND FLOOR PLAN
Keeper's Dwelling HS-09: Existing Conditions

4 0 4 8
SCALE: 1/4" =

Part J:
Preliminary Cost Estimate Summary

Part J: Preliminary Cost Estimate Summary

Appendix B itemizes the preliminary cost estimate for the rehabilitation of the Keeper's Dwellings (HS-09), including the installation of related site utilities. This summary excludes the costs of site development and stabilization, which are addressed in the Cultural Landscape Report.

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Photocopy of drawing by Geo. Y. Wisner, "Light-House Site at Big Sable, Surveyed and drawn under the direction of Captain Charles E.L.B. Davis, U.S.A., Lighthouse Engineer.", 1884.

Figure 2 12
Tracing of the drawing entitled, "Keepers Dwelling for Outer Island, Big Sable Lt. Sta." Pictured Rocks National Lakeshore, undated.

Figure 3 14
Reprinted from Evaluative Investigation at the Au Sable Light Station, Pictured Rocks National Lakeshore, Michigan, 1990 by Bruce A. Jones. (Lincoln, Nebraska, 1994) p. 27.

Figure 4 19
Drawing from Pictured Rocks National Lakeshore, "12' - 0" x 21' - 7 1/2" Brick Oil House, Prepared under the direction of Lieut. Commander D.W. Blamer U.S.N., Light-House Inspector." Undated.

Figure 5 16
Drawing from Pictured Rocks National Lakeshore, " 'E' Tower for Big Sable. Lake Superior. Transmitted to the Office of the Light House Board with my letter dated April 4th 1873, O.M. Poe, Engr. 11th LH Dist."

Figure 6 17
Drawing from Pictured Rocks National Lakeshore, "Tower for Petite Pte Au Sable Mich." Undated.

Figure 7 20
Photograph by Quinn Evans/Architects, 1995.

Figure 8 20
Photograph by Quinn Evans/Architects, 1995.

Figure 9 22
Photograph No. 26-LG-49-5, Record Group 26, Still Pictures Branch of the National Archives and Records Administration.

Figure 10 22
Photograph from the Pictured Rocks National Lakeshore. Original photo June 1920.

Figure 11 23
Photograph from the Pictured Rocks National Lakeshore. Undated. (ca. late 1940s)

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Reprinted from Historic Structures Report, 95% Submittal, Au Sable Lighthouse Complex, Pictured Rocks National Lakeshore, Michigan, 1991 by Enviroscience, Inc. (Eden Prairie, MN).

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Photograph No. 26-LG-49-8, Record Group 26, National Archives and Records Administration.

Figure 14 40
Photograph by Al O'Bright for the National Park Service, Midwest Regional Office. 1984.

Figure 15 40
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Photograph by Michelle Smay, Quinn Evans/Architects. 1995.

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Drawing from Pictured Rocks National Lakeshore, "Au [Big crossed out] Sable Lt. Station, Mich., Modified Cellar Plans." Undated. (circa 1909).

Figure 19 44
Detail drawing taken from the construction drawing, "Au - Sable Light Station, Grand Marais, Michigan, Alterations to Dwelling Sanitary Facilities - Double Dwelling." 1949, revised 1950.

Figure 20 46
Photograph by Michelle Smay, Quinn Evans/Architects. 1995.

Figure 21 46
Photograph by MacDonald and Mack Architects, Ltd. 1991.

Figure 22 47
Tracing of the drawing entitled, "Keepers Dwelling for Outer Island, Big Sable Lt. Sta." Pictured Rocks National Lakeshore, undated.

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Photograph by Michelle Smay, Quinn Evans/Architects. 1995.

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Drawing from Pictured Rocks National Lakeshore, " 'E' Tower for Big Sable. Lake Superior. Transmitted to the Office of the Light House Board with my letter dated April 4th 1873, O.M. Poe, Engr. 11th LH Dist."

Figure 28 52
Photograph by Robert Mack, MacDonald and Mack Architects, Ltd. 1991.

Figure 29 52
Photograph by Michelle Smay, Quinn Evans/Architects. 1995.

Figure 30 52
Photograph No. 26-LG-49-8, Record Group 26, National Archives and Records Administration.

Figure 31 53
Photograph by Michelle Smay, Quinn Evans/Architects. 1995.

Figure 32 54
Detail drawing taken from the construction drawing, "Keeper's Dwelling, Drawing No. 625/ 80007." Undated.

Figure 33 55
Detail drawing taken from the construction drawing, "Au - Sable Light Station, Grand Marais, Michigan, Alterations to Dwelling Sanitary Facilities - Single Dwelling." 1949, revised 1950.

Figure 34 55
Photograph by Michelle Smay, Quinn Evans/Architects. 1995.

Figure 35 55
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Figure 36 56
Photograph by Michelle Smay, Quinn Evans/Architects. 1995.

Figure 37 56
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Detail of drawing from Pictured Rocks National Lakeshore. National Park Service reproduction, "Light Station, Au Sable, Pictured Rocks N.L." of the original drawing, "Keeper's Dwelling." 1908.

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Figure 48 64
Photograph by David Evans, Quinn Evans/Architects. 1995.

Figure 49 64
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Figure 52 65
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Figure 53 67
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Figure 70 87
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Figure 71 87
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Figure 78 100
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Figure 86 104
Photograph by Michelle Smay, Quinn Evans/Architects. 1995.

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Figure 103 120
Photograph by Mark Chavez for the National Park Service, Midwest Regional Office. 1988.

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Photograph from the Pictured Rocks National Lakeshore. Original photo 1950.

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Photograph by Michelle Smay, Quinn Evans/Architects. 1995.

Figure 106 122
Photograph by Mark Chavez for the National Park Service, Midwest Regional Office. 1988.

Figure 107
Photograph by Mark Chavez for the National Park Service, Midwest Regional Office. 1988.

Figure 108 124, 125
Photograph by Michelle Smay, Quinn Evans/Architects. 1995.

Figure 109 127
Photograph by Michelle Smay, Quinn Evans/Architects. 1995.

Figure 110 129
Photograph by Michelle Smay, Quinn Evans/Architects. 1995.

Figure 111 129
Photograph by Michelle Smay, Quinn Evans/Architects. 1995.

Figure 112 132
Photograph by Michelle Smay, Quinn Evans/Architects. 1995.

Figure 113 133
Photograph by Michelle Smay, Quinn Evans/Architects. 1995.

Figure 114 133
Photograph by Robert Mack, MacDonald and Mack Architects, Ltd. 1991.

Figure 115 135
Photograph from the Pictured Rocks National Lakeshore. August 1973.

Figure 116 136
Photograph by Michelle Smay, Quinn Evans/Architects. 1995.

Figure 117 136
Photograph from the Pictured Rocks National Lakeshore. August 1973.

Figure 118 136
Photograph by Michelle Smay, Quinn Evans/Architects. 1995.

Figure 119 136
Photograph by Michelle Smay, Quinn Evans/Architects. 1995.

Figure 120 137
Photograph by Robert Mack, MacDonald and Mack Architects, Ltd. 1991.

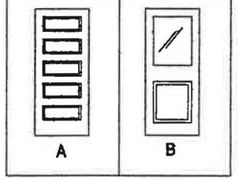
Figure 121 138
Photograph by Robert Mack, MacDonald and Mack Architects, Ltd. 1991.

Appendix A:
Existing Condition Drawings

DOOR SCHEDULE

DOOR NO.	HEIGHT	WIDTH	THICKNESS	STYLE	CONDITION
B01.1					
101.1	83 - 1/2"	32"	1 -3/4"		
101.2	83 - 1/2"	32"	1 -1/4"	MISSING	ALL HARDWARE MISSING.
101.3	83 - 1/2"	32"	1 -1/4"	MISSING	
102.1	83 - 1/2"	32"	1 -1/4"	B	DOORKNOB MISSING, RM 102 SIDE..
104.1	83 - 1/2"	32"	1 -1/4"	B	ALL HARDWARE IS MISSING.
104.2	83 - 1/2"	32"	1 -1/4"	A	NON-ORIGINAL BRASS HARDWARE.
104.3	83 - 1/2"	32"	1 -1/4"		BOTH DOOR KNOBS MISSING; ALL REMAINING HARDWARE IS RUSTED.
105.1	83 - 1/2"	32"	1 -1/4"	B	
105.2	84"	36"	1 -3/4"	MISSING	
106.1	83 - 1/2"	32"	1 -1/4"	A	
201.1	79 -1/2"	32"	1 -1/4"		
201.2	79 -1/2"	32"	1 -1/4"		
202.1	79 -1/2"	32"	1 -1/4"		
202.2	79 -1/2"	32"	1 -1/4"		
203.1	79 -1/2"	32"	1 -1/4"		
203.2	79 -1/2"	32"	1 -1/4"	A	
205.1	79 -1/2"	32"	1 -1/4"		BOTH DOOR KNOBS MISSING; ALL REMAINING HARDWARE IS RUSTED.

DOOR STYLES

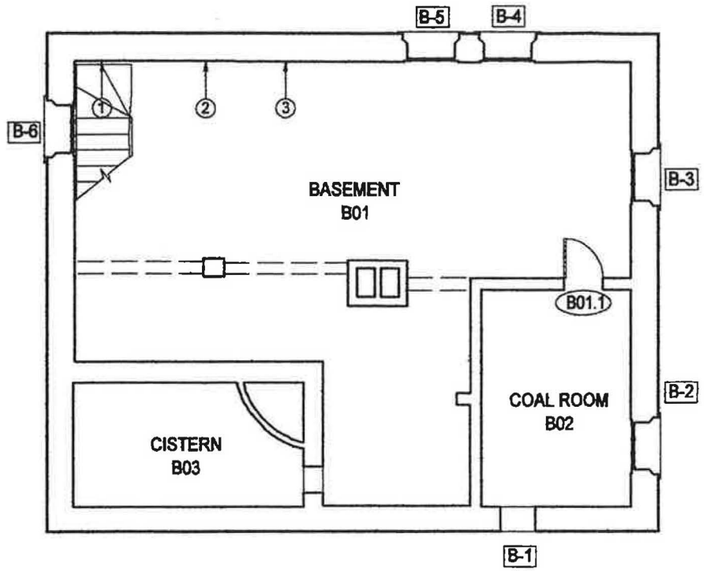


BASEMENT NOTE KEY

1 SPALLED, DETERIORATING PLASTER ABOVE GRADE, ENTIRE WALL.

2 PAINT FAILURE AT BRICK BELOW GRADE, ENTIRE WALL.

3 LOOSE, MISSING MORTAR ALONG BOTTOM OF NORTH WALL.



BASEMENT FLOOR PLAN

Keeper's Dwelling HS-09: Existing Conditions

4 0 4 8

SCALE: 1/4" = 1'-0"

QUINN EVANS ARCHITECTS
219 1/2 N. Main Street
Ann Arbor, Michigan 48104
734.663.5888

ISSUED	
DATE	INITIAL
02/15/09	BLR

PREPARED
DESIGNED S.J. ; B.R.
DRAWN B.R.
CHECKED S.J.
FIRM QUINN EVANS ARCHITECTS

SHEET TITLE: BASEMENT EXISTING CONDITIONS

UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
PLANNING RESOURCE PRESERVATION
MIDWEST SYSTEMS OFFICE

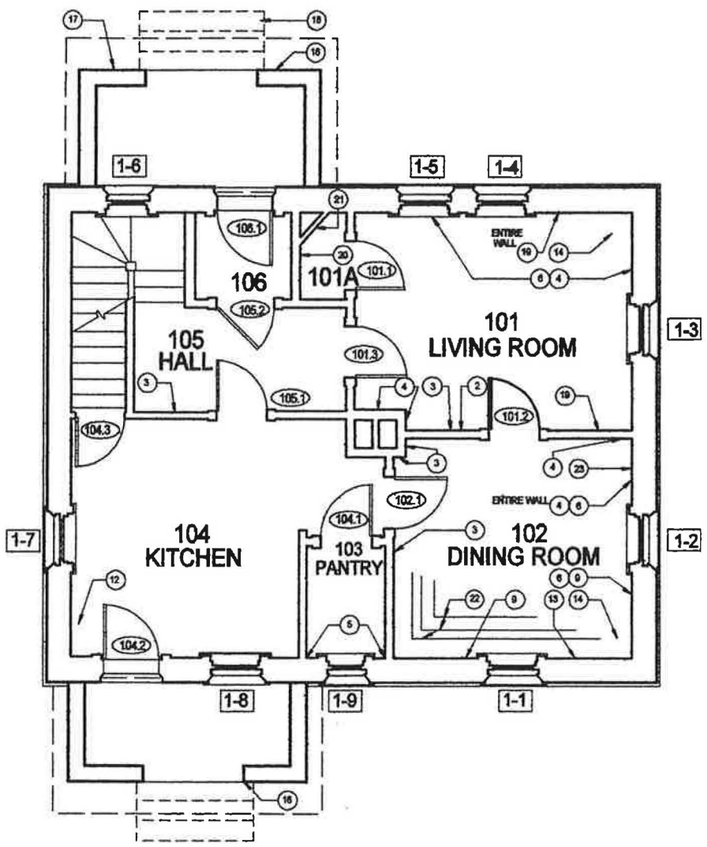
KEEPER'S DWELLING (HS-09)
AU SABLE ISLAND LIGHT STATION
PICTURED ROCKS NATIONAL LAKESHORE
MICHIGAN

FILE NAME: HS9-BLDGN
SUB SHEET NO.: E-101

DRAWING NO.: DRAWING NO.
SHEET 01 OF 09

FIRST FLOOR NOTE KEY

1 STRESS CRACK IN CEILING PLASTER.
2 SURFACE HAIRLINE CRACKS.
3 STRESS CRACKS IN WALL PLASTER.
4 SPALLING, DETERIORATED PLASTER.
5 FULL HEIGHT VERTICAL SETTLEMENT CRACK IN PLASTER.
6 MISSING PLASTER.
7 PLASTER LOOSE FROM SUBSTRATE.
8 TURNED WOOD DOOR STOP AT BASEBOARD IS MISSING.
9 WOOD ROT AT BASEBOARD.
10 BASEBOARD LOOSE / SEPARATED FROM WALL.
11 DAMAGED FLOOR BOARDS.
12 MISSING FLOOR BOARDS.
13 OPENING IN BASEBOARD FROM FORMER HEAT SUPPLY GRILLE
14 OPENING IN FLOOR FROM FORMER RETURN AIR GRILLE.
15 DETERIORATED MORTAR JOINTS.
16 LOOSE AND MISSING MORTAR.
17 SPALLING BRICK.
18 CRACKED / MISSING CONCRETE.
19 WOOD BASEBOARD MISSING.
20 WOOD HOOK RAIL WITH ORIGINAL METAL COAT HOOKS.
21 NON-ORIGINAL PLUMBING SHAFT.
22 DEMARCATION ON FLOOR BOARDS FROM FORMER FLOOR COVERING.
23 DEMARCATION ON PAINT SURFACE INDICATING PREVIOUS LOCATION OF PICTURE MOLDING.

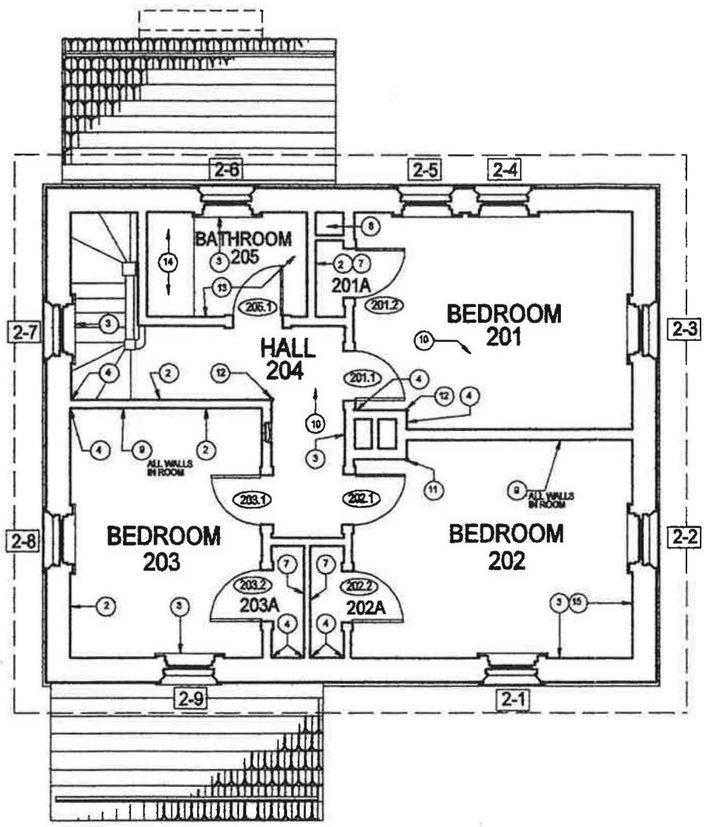


FIRST FLOOR PLAN

Keeper's Dwelling HS-09: Existing Conditions

SECOND FLOOR NOTE KEY

1 STRESS CRACK IN CEILING PLASTER.
2 STRESS CRACKS IN WALL PLASTER.
3 SPALLING, DETERIORATED PLASTER.
4 FULL HEIGHT VERTICAL SETTLEMENT CRACK IN PLASTER.
5 BASEBOARD LOOSE / SEPARATED FROM WALL.
6 OPENING IN BASEBOARD FROM FORMER HEAT SUPPLY GRILLE
7 WOOD HOOK RAIL WITH ORIGINAL METAL COAT HOOKS.
8 NON-ORIGINAL PLUMBING SHAFT.
9 DEMARCATION ON PAINT SURFACE INDICATING PREVIOUS LOCATION OF PICTURE MOLDING.
10 CIRCULAR DEMARCATIONS IN FLOOR BOARDS OF UNKNOWN ORIGIN.
11 DEMARCATION IN PAINT SURFACE INDICATING FORMER LOCTION OF TURNED WOOD CORNER BEAD.
12 TURNED WOOD CORNER BEAD.
13 EVIDENCE IN FLOOR BOARDS AND WALLS, INCLUDING STAINS AND HOLES, FROM FORMER BATHROOM FIXTURES.
14 BATHTUB.
15 PLASTER LOOSE FROM SUBSTRATE.



SECOND FLOOR PLAN

Keeper's Dwelling HS-09: Existing Conditions

4 0 4 8

SCALE: 1/4" = 1'-0"

	QUINN EVANS ARCHITECTS 219 1/2 N. Main Street Ann Arbor, Michigan 48104 734.663.3999	ISSUED DATE 02/15/99 INITIAL BLR	PREPARED DESIGNED S.J.; B.R. DRAWN B.R. CHECKED S.J. FIRM QUINN EVANS ARCHITECTS	SHEET TITLE FIRST AND SECOND FLOOR EXISTING CONDITIONS	UNITED STATES DEPARTMENT OF THE INTERIOR NATIONAL PARK SERVICE PLANNING RESOURCE PRESERVATION MIDWEST SYSTEMS OFFICE KEEPER'S DWELLING (HS-09) AU SABLE ISLAND LIGHT STATION PICTURED ROCKS NATIONAL LAKESHORE MICHIGAN	FILE NAME hs9-1-2.DGN SUB SHEET NO. E-102	DRAWING NO. DRAWING NO. SHEET 02 OF 09

BASEMENT NOTE KEY

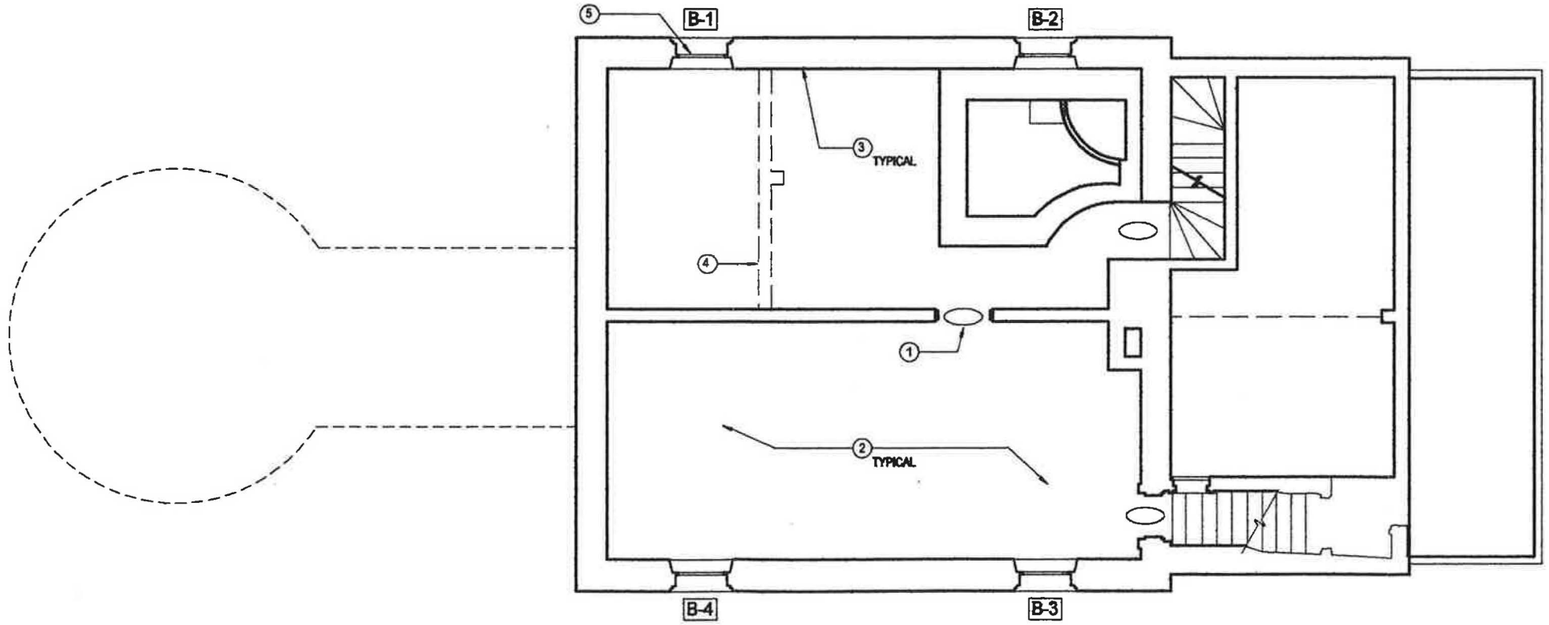
1 MISSING DOOR.

2 PAINTED CONCRETE FLOOR.

3 WHITEWASHED MASONRY STONE WALLS.

4 PREVIOUS LOCATION OF MASONRY WALL; FORMER COAL ROOM.

5 MISSING WINDOW.



BASEMENT FLOOR PLAN

Dual Keepers' Duplex Residence HS-11: Existing Conditions

4 0 4 8

SCALE: 1/4" = 1'-0"

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219 1/2 N. Main Street
Ann Arbor, Michigan 48104
734.663.5888

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02/15/09	SLR

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DESIGNED S.J. ; B.R.
DRAWN B.R.
CHECKED S.J.
FIRM QUINN EVANS ARCHITECTS

SHEET TITLE
BASEMENT EXISTING CONDITIONS

UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
PLANNING RESOURCE PRESERVATION
MIDWEST SYSTEMS OFFICE

DOUBLE KEEPERS' DUPLEX RESIDENCE (HS-11)
AU SABLE ISLAND LIGHT STATION
PICTURED ROCKS NATIONAL LAKESHORE
MICHIGAN

FILE NAME HS11-B.DGN
SUB SHEET NO. E-103

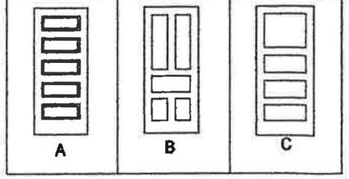
DRAWING NO. DRAWING NO.
SHEET 03 OF 09

DOOR SCHEDULE

DOOR NO.	HEIGHT	WIDTH	THICKNESS	STYLE	CONDITION
101.A	84"	36"	1 -3/4"	C	NON-HISTORIC BRASS HARDWARE.
101.B	79 - 3/4"	32"	1 -3/8"	A	HISTORIC HARDWARE; NON-HISTORIC HINGES.
102.A	79 - 3/4"	31 -3/4"	1 -3/8"	A	1910 HARDWARE.
102.B	84 - 3/4"	31 -3/4"	1 -3/8"	B	1874 HARDWARE
103.A	82 - 1/2"	28"	1 -3/8"	B	DOOR KNOBS MISSING.
103.B	82 - 3/4"	28"	1 -3/8"	B	DOOR KNOBS MISSING.
105.A	79 - 3/4"	27 - 1/2"	1 -3/8"	B	DOOR KNOBS MISSING, NON-HISTORIC HINGES.
105.B	83"	24"	1 -3/8"	B	DOOR KNOB AND LATCH BOX MISSING.
108.A	83 - 3/4"	32"	1 -3/8"	MISSING	ENTIRE DOOR MISSING.
108.B	79 - 3/4"	32"	1 -3/8"	A	1910 HARDWARE.
108.C	83 - 3/4"	32"	1 -3/8"	B	1874 HINGES; DOOR KNOBS AND LOCK BOX MISSING
110.A	79 -7/8"	32"	1 -3/8"	MISSING	ENTIRE DOOR MISSING.
110.B	79 - 3/4"	30"	1 -3/8"	A	1910 HARDWARE.
112.A	84"	36"	1 -3/4"	C	NON-HISTORIC BRASS HARDWARE.
P.01			"		
P.02			"		
P.03			"		

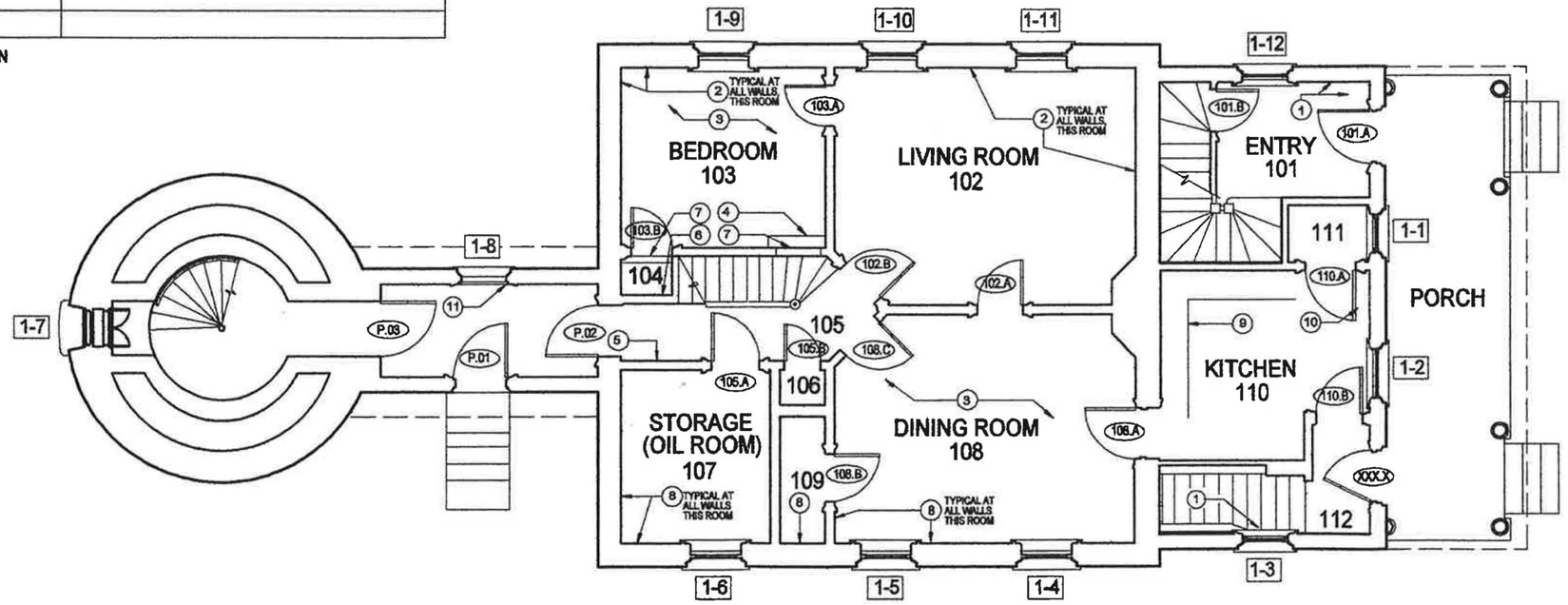
DOOR SCHEDULE BASED ON PHYSICAL INVESTIGATION UNDERTAKEN BY MARK CHAVEZ IN 1988.

DOOR STYLES



FIRST FLOOR NOTE KEY

1 DETERIORATED PLASTER.
2 LOCATION OF FORMER PICTURE MOLDING.
3 AREAS OF PAINT BUILD-UP ON FLOOR SURFACE.
4 PREVIOUS LOCATION OF STEP(S).
5 PREVIOUS LOCATION OF DOOR OPENING.
6 NON-ORIGINAL WOOD BASEBOARD TRIM.
7 NON-ORIGINAL HEADER.
8 WOOD WAINSCOT.
9 DEMARCATION ON FLOOR BOARDS FROM FORMER FLOOR COVERING.
10 AREA OF PATCHED FLOOR BOARDS.
11 NON-PERIOD BRASS HINGES AT WINDOW.



FIRST FLOOR PLAN

Dual Keepers' Duplex Residence HS-11: Existing Conditions

4 0 4 8

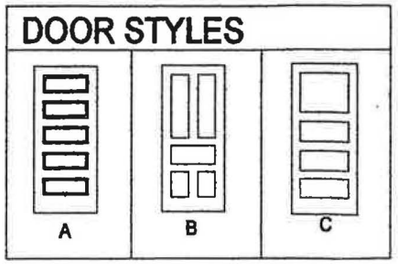
SCALE: 1/4" = 1'-0"

	QUINN EVANS ARCHITECTS 219 1/2 N. Main Street Ann Arbor, Michigan 48104 734.663.5888	ISSUED DATE 02/15/99 INITIAL BLR	PREPARED DESIGNED S.J.; B.R. DRAWN B.R. CHECKED S.J. FIRM QUINN EVANS ARCHITECTS	SHEET TITLE FIRST FLOOR EXISTING CONDITIONS	UNITED STATES DEPARTMENT OF THE INTERIOR NATIONAL PARK SERVICE PLANNING RESOURCE PRESERVATION MIDWEST SYSTEMS OFFICE DOUBLE KEEPERS' DUPLEX RESIDENCE (HS-11) AU SABLE ISLAND LIGHT STATION PICTURED ROCKS NATIONAL LAKESHORE MICHIGAN	FILE NAME HS11-1.DGN SUB SHEET NO. E-104	DRAWING NO. DRAWING NO. SHEET 04 OF 09

S	STYLE	CONDITION
	A	1910 HARDWARE.
	MISSING	ENTIRE DOOR MISSING; LOWER DOOR HINGE INTACT.
	A	HISTORIC HARDWARE IN PLACE.
	B	HISTORIC HARDWARE IN PLACE.
	B	HISTORIC HARDWARE IN PLACE.
	A	HISTORIC HARDWARE IN PLACE.
	B	HISTORIC HARDWARE IN PLACE.
	B	HISTORIC LOCKSET MISSING.
	B	HISTORIC HARDWARE; NON-HISTORIC HINGES.

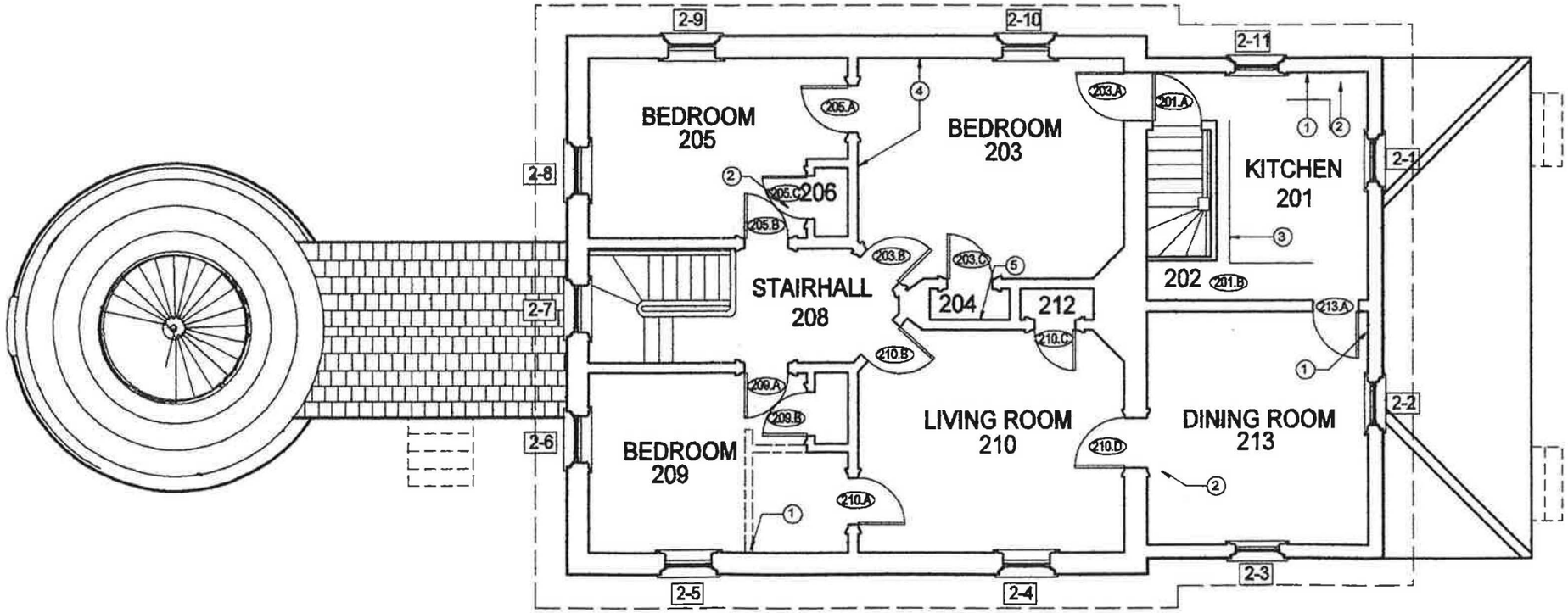
ATION

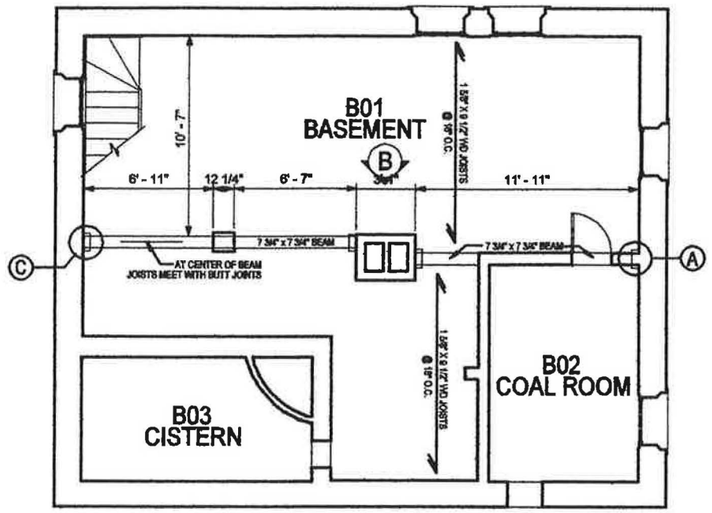
DOOR STYLES

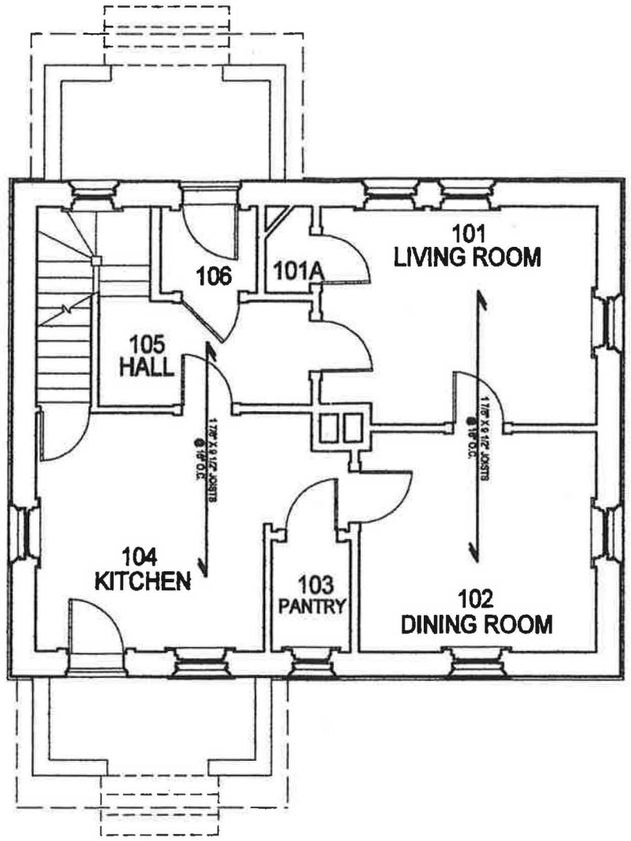


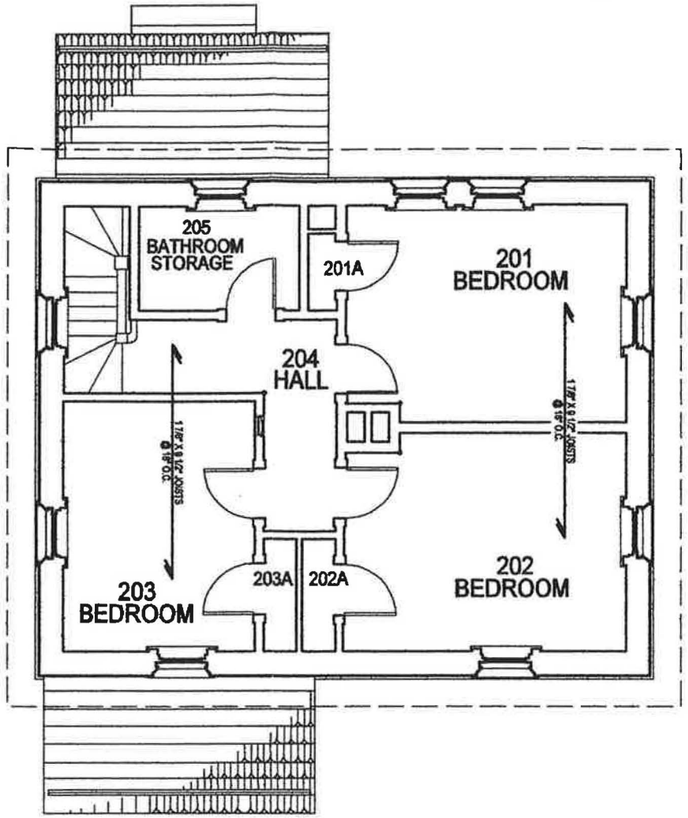
SECOND FLOOR NOTE KEY

1 DETERIORATED / CRACKING PLASTER.
2 AREA OF PATCHED FLOOR BOARDS.
3 DEMARCATION ON FLOOR BOARDS FROM FORMER FLOOR COVERING.
4 LOCATION OF FORMER PICTURE MOLDING.
5 ALL ORIGINAL METAL COAT HOOKS INTACT.
6 NON-HISTORIC BRASS HINGES.









BASEMENT STRUCTURAL PLAN

Keeper's Dwelling HS-09: Existing Conditions

FIRST FLR STRUCTURAL PLAN

Keeper's Dwelling HS-09: Existing Conditions

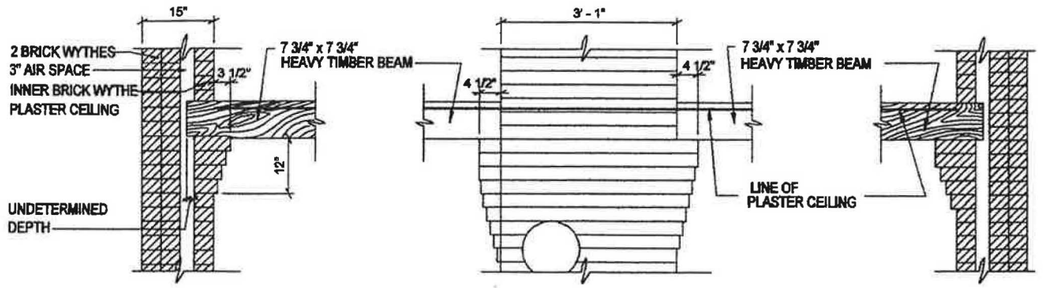
SECOND FLR STRUCTURAL PLAN

Keeper's Dwelling HS-09: Existing Conditions

STRUCTURAL DETAILS

SCALE: 3/4" = 1'-0"

4 0 4 8



4 0 4 8

SCALE: 1/4" = 1'-0"

QUINN EVANS ARCHITECTS
219 1/2 N. Main Street
Ann Arbor, Michigan 48104
734.663.5888

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02/15/99	BLR

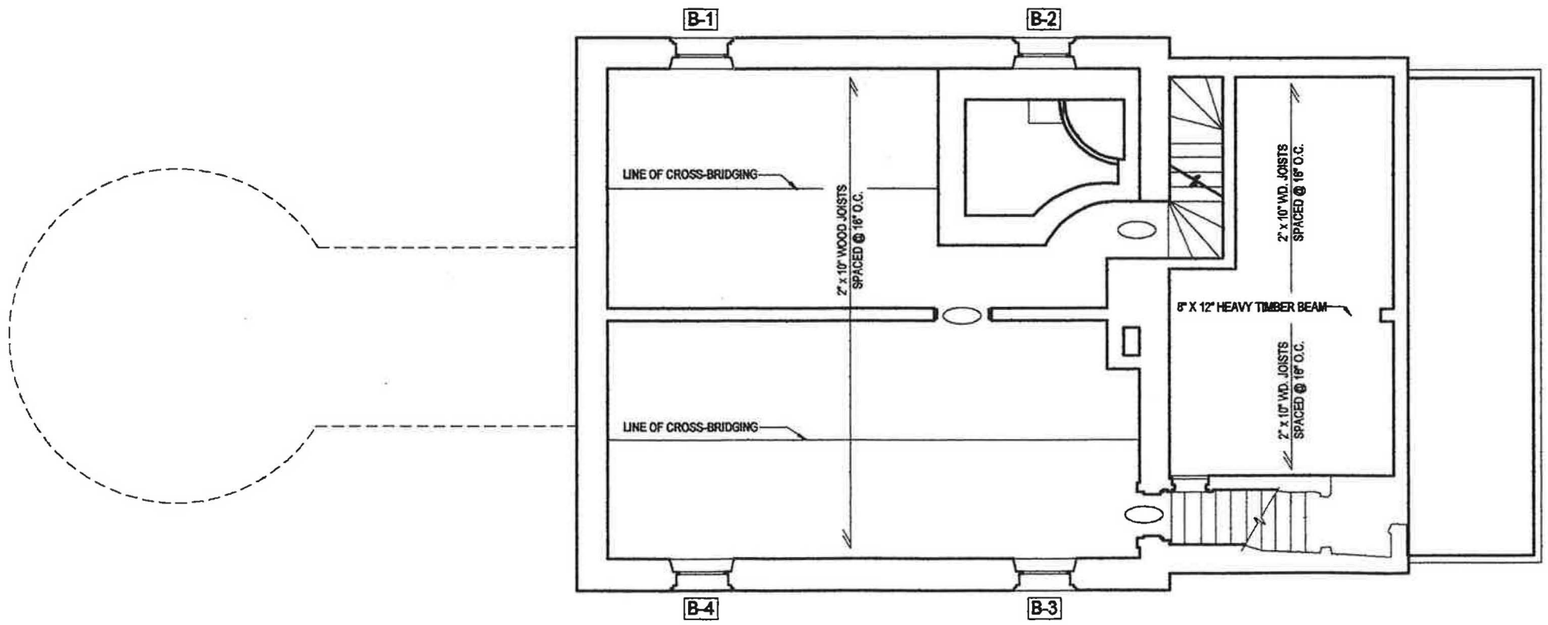
PREPARED
DESIGNED S.J.; B.R.
DRAWN B.R.
CHECKED S.J.
FIRM QUINN EVANS ARCHITECTS

SHEET TITLE
STRUCTURAL PLANS EXISTING CONDITIONS

UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
PLANNING RESOURCE PRESERVATION
MIDWEST SYSTEMS OFFICE

KEEPER'S DWELLING (HS-09)
AU SABLE ISLAND LIGHT STATION
PICTURED ROCKS NATIONAL LAKESHORE
MICHIGAN

FILE NAME HS9-STR.DGN
SUB SHEET NO. S-001
DRAWING NO. DRAWING NO.
SHEET 06 OF 09



FIRST FLOOR STRUCTURAL PLAN

Dual Keepers' Duplex Residence HS-11: Existing Conditions

4 0 4 8

SCALE: 1/4" = 1'-0"

QUINN EVANS ARCHITECTS
219 1/2 N. Main Street
Ann Arbor, Michigan 48104
734.663.5888

ISSUED	
DATE	INITIAL
02/15/09	BLR

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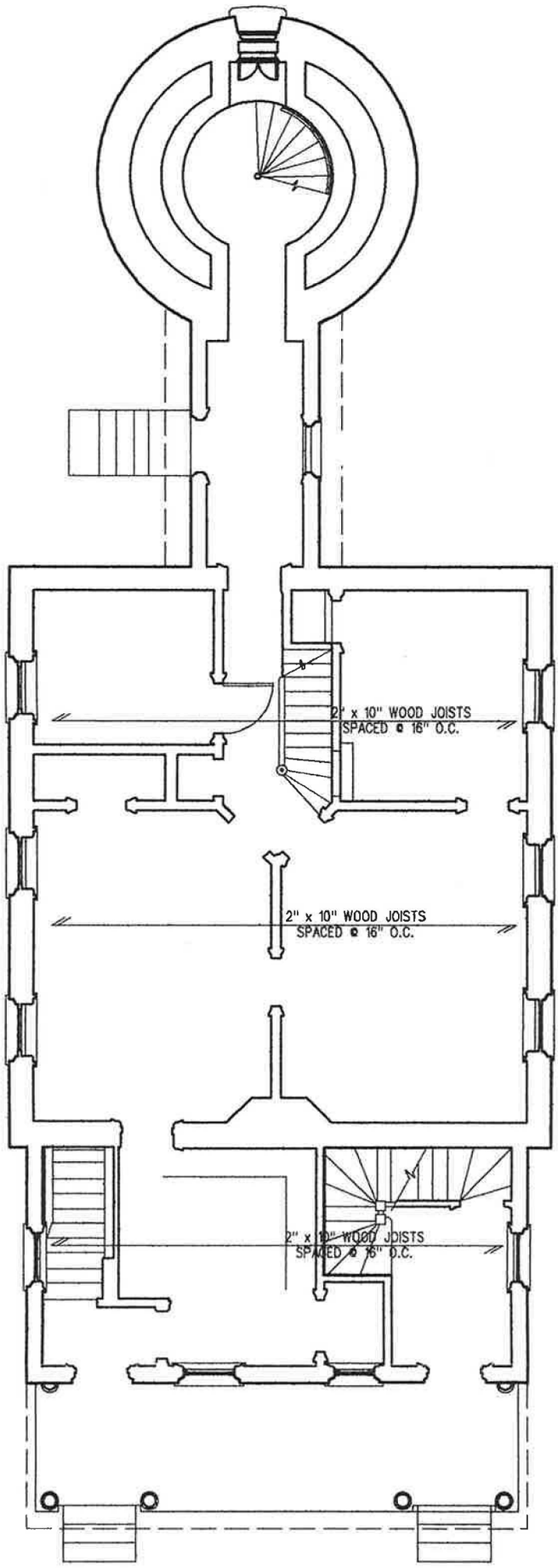
DRAWN B.R.
CHECKED S.J.
FIRM QUINN EVANS ARCHITECTS

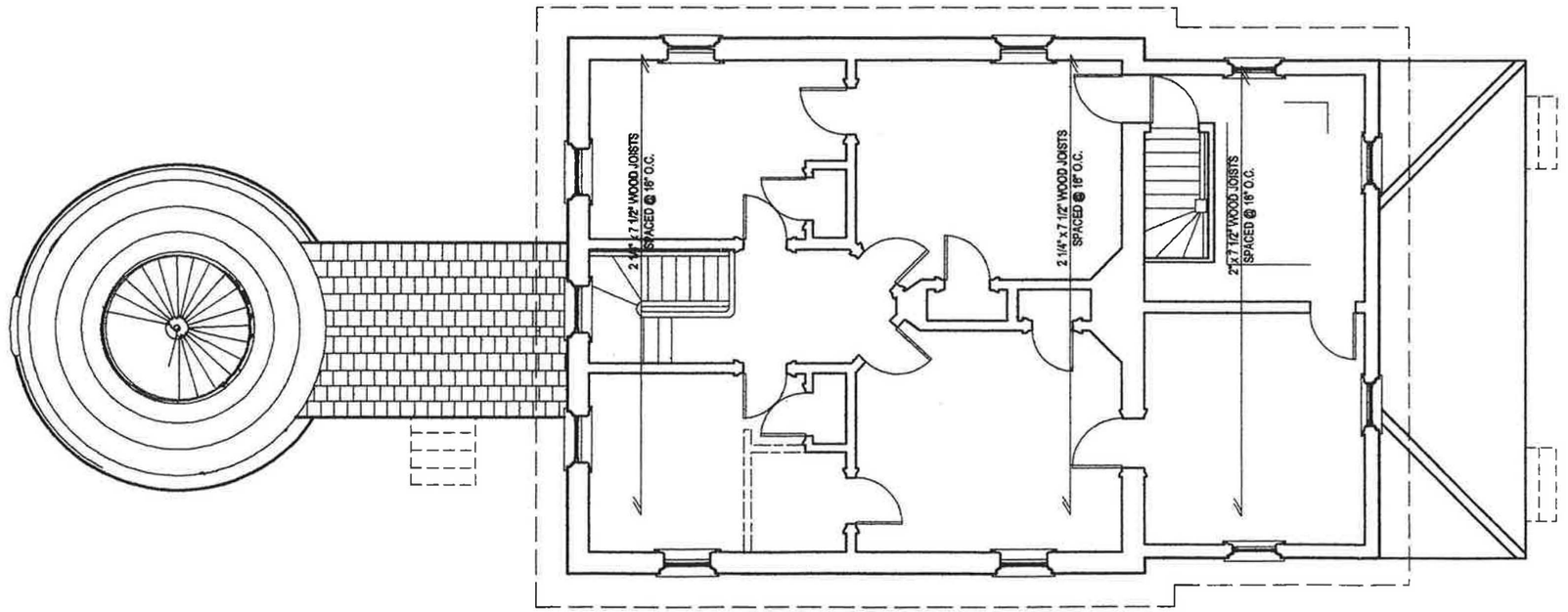
SHEET TITLE
FIRST FLOOR STRUCTUAL PLAN

UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
PLANNING RESOURCE PRESERVATION
MIDWEST SYSTEMS OFFICE

DOUBLE KEEPERS' DUPLEX RESIDENCE (HS-11)
AU SABLE ISLAND LIGHT STATION
PICTURED ROCKS NATIONAL LAKESHORE
MICHIGAN

FILE NAME HS11STR1.DGN
SUB SHEET NO. S-002
DRAWING NO. DRAWING NO.
SHEET 07 OF 09


2" x 10" WOOD JOISTS
SPACED @ 16" O.C.
2" x 10" WOOD JOISTS
SPACED @ 16" O.C.
2" x 10" WOOD JOISTS
SPACED @ 16" O.C.



ATTIC FLOOR STRUCTURAL PLAN

Dual Keepers' Duplex Residence HS-11: Existing Conditions

4 0 4 8

SCALE: 1/4" = 1'-0"

QUINN EVANS ARCHITECTS
219 1/2 N. Main Street
Ann Arbor, Michigan 48104
734.663.5888

ISSUED	
DATE	INITIAL
02/15/99	BLR

PREPARED
DESIGNED S.J. ; B.R.
DRAWN B.R.
CHECKED S.J.
FIRM QUINN EVANS ARCHITECTS

SHEET TITLE: ATTIC STRUCTURAL PLAN

UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
PLANNING RESOURCE PRESERVATION
MIDWEST SYSTEMS OFFICE

DOUBLE KEEPERS' DUPLEX DWELLING (HS-11)
AU SABLE ISLAND LIGHT STATION
PICTURED ROCKS NATIONAL LAKESHORE
MICHIGAN

FILE NAME: HS11STRLDGN
SUB SHEET NO.: S-004
DRAWING NO.: DRAWING NO.
SHEET 09 OF 09

Appendix B:
Structural and Loading Analysis

fb	1400 psi
fv	80 psi
Shear increase	1 1/2

Joists

Name	Weight lb/ft	A si	Ix	Iy	E ksi	D in	B in	Sxt	Syl	rx	ry	rz	Mx cap lb ft	Vycap lb
1.63 x 9.5	3.8	15.44	116.1	3.4	1400	9 1/2	1 5/8	24.4	4.2	2.742	0.469	0.469	3279	1235
1.88 x 9.75	4.5	18.33	145.2	5.4	1400	9 3/4	1 7/8	29.8	5.7	2.815	0.543	0.543	3996	1466
1.88 x 9.5	4.3	17.81	134.0	5.2	1400	9 1/2	1 7/8	28.2	5.6	2.742	0.541	0.541	3784	1425
2 x 5.5	2.7	11.00	27.7	3.7	1400	5 1/2	2	10.1	3.7	1.588	0.577	0.577	1353	880
2 x 10	4.9	20.00	166.7	6.7	1400	10	2	33.3	6.7	2.887	0.577	0.577	4472	1600
2.25 x 7.5	4.1	16.88	79.1	7.1	1400	7 1/2	2 1/4	21.1	6.3	2.165	0.65	0.65	2830	1350
3 x 6	4.4	18.00	54.0	13.5	1400	6	3	18.0	9.0	1.732	0.866	0.866	2415	1440
2 x 7.5	3.6	15.00	70.3	5.0	1400	7 1/2	2	18.8	5.0	2.165	0.577	0.577	2516	1200
1.75 x 6	2.6	10.50	31.5	2.7	1400	6	1 3/4	10.5	3.1	1.732	0.505	0.505	1409	840

Beams

Name	Weight lb/ft	A si	Ix	Iy	E ksi	D in	B in	Sxt	Syl	rx	ry	rz	Mx cap lb ft	Vycap lb
7.75 x 7.75	14.6	60.06	300.6	300.6	1400	7 3/4	7 3/4	77.6	77.6	2.237	2.237	2.237	9051	4805
8 x 12	23.3	96.00	1152.0	512.0	1400	12	8	192.0	128.0	3.464	2.309	2.309	22400	7680

Au Sable

Load Limits of structures with minimum shoring;

Shores				
HS-11	West area		Live load is easily increased to 100 psf	Add shores each side of center wall in the basement on the west side. Locate shores below stair walls above and extend system about 14 feet from the west wall toward the east.
HS-11	East area		Live load for all floors can be 100 psf	Add beam and post shore in the east west direction approximately 2' -6 north of existing beam line. The beam should align with the stair wall above.
HS-9	West side levels 1 & 2	7 3/4 x 7 3/4 beam at level 1	Live load of all levels is increased to > 100 psf	Add post shore at midspan of each span (2 shores) at west side; Wall below beam at east side is assumed to support the beam.

Au Sable

Load Limits of structures as built;

Building	Area	Member	Superimposed Load Limit	Comments
HS-11	205, 208, 209 103, 105, 107	Joists Joists	30psf 75 psf	Assumes no attic live load; Both bending and shear stress limit.
HS-11	203, 210 102, 108	Joists Joists	120 psf 130 psf	Assumes no attic live load; Limited by both shear and bending.
HS-11	201, 213 101, 110	Joists Joists	30 psf 40 psf	Assumes no live load at attic; Joists at level 1 limit in shear at 8 x 12 beam; Assumes that all joists with holes are restored with gussets to original capacity.
HS-11	Level 2 Level 1	Beam 8 x 12	30 psf 40 psf	Beam is approximately 17% overstressed in bending and 4% overstressed in shear at these load levels (taken from joists above).
HS-9	West side Level 2 Level 1	 Joists Joists	 100 psf 100 psf	Attic assumed at 0 live load; Shear limits the capacity of the floors.
HS-9	East side Level 2 Level 1	 Joists Joists	 ≥ 120 psf ≥ 120 psf	Attic assumed to be 20 psf live load; Shear & bending both limit the capacity of the joists.
HS-9	West side Level 2 & 1	7 3/4 x 7 3/4 beam at level 1	Live load max is about 25 to 30 psf all floors as limited by the beam.	Beam limited by shear; Can increase the floor capacity to above joist limits by addition of shore posts.

Appendix C:
Preliminary Cost Estimates

94117-04 Au Sable Light Station
Summary of Recommended Work and Estimate of Probable Costs

OVERALL SITE	Qty	Unit	Cost/Unit	Subtotal	multipliers 0.07 Gen Con	0.214 GC OVHD	0.257 Conting	Total	CSI Total
1 General Requirements (entire site)									**$143,804**
Permits.	80		$10.00	$800	$56	$171	$206	$1,233	
Equipment.	1		$1,500.00	$1,500	$105	$321	$386	$2,312	
Dumpsters.	1		$550.00	$550	$39	$118	$141	$848	
Debris Removal.	1		$3,000.00	$3,000	$210	$642	$771	$4,623	
General Hand Labor.	20	wk	$1,000.00	$20,000	$1,400	$4,280	$5,140	$30,820	
Supervision.	20	wk	$2,400.00	$48,000	$3,360	$10,272	$12,336	$73,968	
Insurance.	0.02	%		$30,000				$30,000	

	Qty	Unit	Cost/Unit	Subtotal	Gen Con	GC OVHD	Conting	Total	CSI Total
2 Site Construction									**$339,020**
Repair broken walks.	100	sy	$50.00	$5,000	$350	$1,070	$1,285	$7,705	
Widen existing walks to a total width of 5'.	500	lf	$30.00	$15,000	$1,050	$3,210	$3,855	$23,115	
Construct 5' wide walks to and from the parking area.	1000	lf	$200.00	$200,000	$14,000	$42,800	$51,400	$308,200	
Grading to allow handicapped access to outbuildings.		sy							
New underground sewage tank.									

	Qty	Unit	Cost/Unit	Subtotal	Gen Con	GC OVHD	Conting	Total	CSI Total
10 Specialties									**$7,705**
New privy, handicapped-accessable.	1	ea	$5,000.00	$5,000	$350	$1,070	$1,285	$7,705	

	Qty	Unit	Cost/Unit	Subtotal	Gen Con	GC OVHD	Conting	Total	CSI Total
15 Mechanical									
Water supply and distribution system.	Allowance by owner.								
500 gal underground septic tank.	Allowance by owner.								
Accessible, public vault toilets.	Allowance by owner.								

	Qty	Unit	Cost/Unit	Subtotal	Gen Con	GC OVHD	Conting	Total	CSI Total
16 Electrical									
Electrical power and distribution system.	Allowance by owner.								
OVERALL SITE TOTAL									**$490,529**

KEEPER'S DWELLING (HS-09)

	Qty	Unit	Cost/Unit	Subtotal	Gen Con	GC OVHD	Conting	Total	CSI Total
2 Site Construction									**$28,476**
Exterior:									
Removal of west porch wall at south entrance to accommodate ramp.	24	cf	$1.32	$32	$2	$7	$8	$49	
UFAS compliant ramp at south elevation of Dwelling.	1	ea	$4,000.00	$4,000	$280	$856	$1,028	$6,164	
Excavate, by hand, perimeter of foundation to footings	212	cu	$35.00	$7,420	$519	$1,588	$1,907	$11,434	
Insert new perimeter drain system.	119	lf	$4.00	$476	$33	$102	$122	$733	
Remove deteriorated parging.	500	sf	$4.00	$2,000	$140	$428	$514	$3,082	
Backfill by hand, no compaction.	212	cu	$13.00	$2,756	$193	$590	$708	$4,247	
Remove existing roof shingles.	1620	sf	$0.49	$794	$56	$170	$204	$1,224	

Remove deteriorated sheathing.	800 sf	$0.33	$264	$18	$56	$68	$406	
Interior:								
Remove unsound plaster.	1200 sf	$0.50	$600	$42	$128	$154	$924	
Remove plumbing fixtures in Room 205.	3 ea	$40.00	$120	$8	$26	$31	$185	
Remove deteriorated baseboard.	63 lf	$0.29	$18	$1	$4	$5	$28	
Lead abatement.	Allowance by owner.							

	Qty	Unit	Cost/Unit	Subtotal	Gen Con	GC OVHD	Conting	Total	CSI Total
3 Concrete									**$261**
Add 3" slab to top of south porch for handicapped access.	19	cu	$6.00	$113	$8	$24	$29	$174	
Formwork for above	25	lf	$2.27	$57	$4	$12	$15	$88	

	Qty	Unit	Cost/Unit	Subtotal	Gen Con	GC OVHD	Conting	Total	CSI Total
4 Masonry									**$223,670**
Foundation/Basement:									
Repair foundation distress, surface spalls, and cracks as needed.	150	sf	$55.00	$8,250	$578	$1,766	$2,120	$12,714	
Repair spalled and deteriorated brick.	150	sf	$55.00	$8,250	$578	$1,766	$2,120	$12,714	
Tuckpoint interior and exterior as required.	300	sf	$8.00	$2,400	$168	$514	$617	$3,699	
Apply new parging at exterior.	357	sf	$8.00	$2,856	$200	$611	$734	$4,401	
Upper Walls:									
Repair spalled and deteriorated brick.	500	sf	$55.00	$27,500	$1,925	$5,885	$7,068	$42,378	
Tuckpoint as required.	500	sf	$8.00	$4,000	$280	$856	$1,028	$6,164	

	Qty	Unit	Cost/Unit	Subtotal	Gen Con	GC OVHD	Conting	Total	CSI Total
6 Wood and Plastics									**$20,380**
Exterior:									
Consolidate any deteriorated wood with epoxy prior to new paint application.	100	sf	$1.50	$150	$11	$32	$39	$232	
Install removable plywood security shutters at all windows.	24	ea	$200.00	$4,800	$336	$1,027	$1,234	$7,397	
Interior:									
Increase live load capacity of both floors to >100 psf by adding a post shore at the midspan of the beam on either side of the chimney.	2	ea	$150.00	$300	$21	$64	$77	$462	
Widen door openings to 36" at first floor to meet UFAS.	9	ea	$300.00	$2,700	$189	$578	$694	$4,161	
Recreate original east wall and doorway in Room 104.	5	lf	$100.00	$500	$35	$107	$129	$771	
Recreate cupboard from Room 104; install.	1	ea	$2,000.00	$2,000	$140	$428	$514	$3,082	
Create and install new baseboard to match existing.	130	lf	$12.00	$1,560	$109	$334	$401	$2,404	
Create & install new picture rail to match existing.	80	lf	$12.00	$960	$67	$205	$247	$1,479	
Create and install new corner beads to match existing.	2	ea	$25.00	$50	$4	$11	$13	$78	
Create and install new casing on Door 104.2 to match existing in room.	17	lf	$12.00	$204	$14	$44	$52	$314	

	Qty	Unit	Cost/Unit	Subtotal	Gen Con	GC OVHD	Conting	Total	CSI Total
7 Thermal and Moisture Protection									**$58,560**

Repair or replace deteriorated sheathing.	400 sf	$8.00	$3,200	$224	$685	$822	$4,931	
Replace deteriorated areas of flashing.	150 lf	$3.00	$450	$32	$96	$116	$694	
Install new stamped metal shingles, prepainted to match the existing shingles.	1620 sf	$20.00	$32,400	$2,268	$6,934	$8,327	$49,929	
Install new gutters.	150 lf	$10.00	$1,500	$105	$321	$386	$2,312	
Install new downspouts.	150 lf	$3.00	$450	$32	$96	$116	$694	

	Qty	Unit	Cost/Unit	Subtotal	Gen Con	GC OVHD	Conting	Total	CSI Total
8 Doors and Windows									**$30,512**
Windows:									
Restore or reconstruct sash to match historic sash. Install new sash cords as required.	24	ea	$300.00	$7,200	$504	$1,541	$1,850	$11,095	
Reconstruct or consolidate all deteriorated jambs and sills as required.	24	ea	$300.00	$7,200	$504	$1,541	$1,850	$11,095	
Doors:									
New, wider doors at first floor to match historic patterns.	9	ea	$600.00	$5,400	$378	$1,156	$1,388	$8,322	

	Qty	Unit	Cost/Unit	Subtotal	Gen Con	GC OVHD	Conting	Total	CSI Total
9 Finishes									**$112,266**
Exterior:									
Sand, prime and paint exterior woods surfaces according to historic paint analysis.	500	sf	$8.00	$4,000	$280	$856	$1,028	$6,164	
Prime and paint new stamped metal shingles to match historic paint analysis prior to installation.	1620	sf	$8.00	$12,960	$907	$2,773	$3,331	$19,971	
Prime and paint window exteriors according to historic paint analysis.	24	ea	$100.00	$2,400	$168	$514	$617	$3,699	
Masonry									
Remove efflourescence.	500	sf	$1.50	$750	$53	$161	$193	$1,157	
Remove lichen and staining; treat brick to prevent future organic growth.	500	sf	$1.50	$750	$53	$161	$193	$1,157	
Interior:									
Replace areas of missing/damaged flooring.	50	sf	$7.00	$350	$25	$75	$90	$540	
Strip, sand, stain and refinish floors that historically had natural finishes.	600	sf	$10.00	$6,000	$420	$1,284	$1,542	$9,246	
Strip, sand and repaint floors that historically had painted finishes.	600	sf	$8.00	$4,800	$336	$1,027	$1,234	$7,397	
Where unsound plaster was removed, repair exposed masonry substrate, replace rotted nailing strips, install new metal lath and plaster.	1200	sf	$10.00	$12,000	$840	$2,568	$3,084	$18,492	
At interior walls, install new drywall where unsound plaster was removed.	700	sf	$7.00	$4,900	$343	$1,049	$1,259	$7,551	
Patch areas of missing/damaged plaster.	1000	sf	$4.00	$4,000	$280	$856	$1,028	$6,164	
Skim coat new wall/ceiling surfaces.	1700	sf	$1.00	$1,700	$119	$364	$437	$2,620	

Paint wall and ceiling surfaces throughout in accordance with the historic paint analysis and period of interpretation.	6000 sf	$2.00	$12,000	$840	$2,568	$3,084	$18,492	
Strip any paint or old varnish from trim throughout. Sand, stain, and refinish trim.	1500 lf	$4.00	$6,000	$420	$1,284	$1,542	$9,246	
Finish new wood trim to match existing.	120 lf	$2.00	$240	$17	$51	$62	$370	

	Qty	Unit	Cost/Unit	Subtotal	Gen Con	GC OVHD	Conting	Total	CSI Total
15 Mechanical									**$18,324**
Fire Suppression: base service.	1	ea	$5,000.00	$5,000	$350	$1,070	$1,285	$7,705	
Wet System	1620	sf	$2.00	$3,240	$227	$693	$833	$4,993	
Dry System	0	sf	$4.00						
Pre-Action System	0	sf	$7.00						
Fire Cycle System	0	sf	$8.00						
Heating: Adapt 1949 passive heating system for limited use, using electric heat or a propane-operated heating unit.	Allowance by owner.								
Heat Distribution and Ventilation: Install new air distribution system in the location of the historic system.	Allowance by owner.								
Replace metal floor grille in Room 105.	1	ea	$150.00	$150	$11	$32	$39	$232	
Plumbing:									
Install new water heater.	1	ea	$500.00	$500	$35	$107	$129	$771	
Install new prefabricated shower unit in Room 205.	1	ea	$1,000.00	$1,000	$70	$214	$257	$1,541	
Install new sink with attached base cabinet in Room 205.	1	ea	$1,000.00	$1,000	$70	$214	$257	$1,541	
Install new low volume flush toilet in Room 205.	1	ea	$1,000.00	$1,000	$70	$214	$257	$1,541	
First floor fixures.	Allowance by owner.								
Connect new toilet(s) to a new underground storage tank. Vent through a new stack at the location of the current stack.	Allowance by owner.								

	Qty	Unit	Cost/Unit	Subtotal	Gen Con	GC OVHD	Conting	Total	CSI Total
16 Electrical									**$0**
Inspect integrity of existing wiring.	Allowance by owner.								
Install additional fixtures/receptacles to meet code.	Allowance by owner.								
Rewire historic fixtures to current UL standards.	Allowance by owner.								
Replace existing service feeder with a new pipe and wire connection.	Allowance by owner.								
Electrical Distribution Panel.	Allowance by owner.								
Service to site.	Allowance by owner.								
Security system.	Allowance by owner.								

KEEPER'S DWELLING (HS-09) TOTAL **$492,449**

DUPLEX KEEPERS DWELLING (HS-11)

(includes Passageway)

	Qty	Unit	Cost/Unit	Subtotal	Gen Con	GC OVHD	Conting	Total	CSI Total
2 Site Construction									**$8,241**
UFAS compliant ramp at east porch entrances to Dwelling.	1	ea	$4,000.00	$4,000	$280	$856	$1,028	$6,164	
Raise level of east porch to interior floor level.	1	ea	$1,000.00	$1,000	$70	$214	$257	$1,541	
Remove shingles and deteriorated sheathing at northeast corner of Dwelling.	100	sf	$0.82	$82	$6	$18	$21	$127	
Interior:									
Remove unsound plaster.	530	sf	$0.50	$265	$19	$57	$68	$409	

	Qty	Unit	Cost/Unit	Subtotal	Gen Con	GC OVHD	Conting	Total	CSI Total
4 Masonry									**$3,699**
Tuckpoint exterior as required, particularly the area under Window 1-3.	300	sf	$8.00	$2,400	$168	$514	$617	$3,699	

	Qty	Unit	Cost/Unit	Subtotal	Gen Con	GC OVHD	Conting	Total	CSI Total
6 Wood and Plastics									**$10,710**
Exterior:									
Replace deteriorated wood at the east porch in kind.	100	lf	$12.00	$1,200	$84	$257	$308	$1,849	
Interior:									
Widen door openings to 36" at the first floor to meet UFAS.	11	ea	$300.00	$3,300	$231	$706	$848	$5,085	
Restore joists with gussets to cover holes from previous mechanical systems.	20	ea	$10.00	$200	$14	$43	$51	$308	
Add shores in the original basement, on either side of the center mansonry wall.	2	ea	$150.00	$300	$21	$64	$77	$462	
At the 1909 basement, insert post and beam shore in the east-west direction, approximately 2'-6" north of the existing beams.	1	ea	$150.00	$150	$11	$32	$39	$232	
Rooms 102, 103, 203: Create and install picture moldings to match existing.	150	lf	$12.00	$1,800	$126	$385	$463	$2,774	

	Qty	Unit	Cost/Unit	Subtotal	Gen Con	GC OVHD	Conting	Total	CSI Total
7 Thermal and Moisture Protection									**$7,475**
Install new sheathing at northeast corner of Dwelling.	100	sf	$8.00	$800	$56	$171	$206	$1,233	
Reinstall shingles at northeast corner of Dwelling.	100	sf	$10.00	$1,000	$70	$214	$257	$1,541	
Repair/replace any other damaged areas of Dwelling or Passageway roof.	200	sf	$5.00	$1,000	$70	$214	$257	$1,541	
Install new gutters.	175	lf	$10.00	$1,750	$123	$375	$450	$2,698	
Install new downspouts.	100	lf	$3.00	$300	$21	$64	$77	$462	

	Qty	Unit	Cost/Unit	Subtotal	Gen Con	GC OVHD	Conting	Total	CSI Total
9 Finishes									**$12,544**
Exterior Brick Surfaces:									
Remove lichen at the Passageway south elevation, apply chemical stains to inhibit organic growth.	140	sf	$6.00	$840	$59	$180	$216	$1,295	
Interior:									

Where unsound plaster was removed, repair exposed masonry substrate, replace rotted nailing strips, install new metal lath and plaster.	530 sf	$10.00	$5,300	$371	$1,134	$1,362	$8,167	
Patch areas of missing/damaged plaster.	500 sf	$4.00	$2,000	$140	$428	$514	$3,082	

	Qty	Unit	Cost/Unit	Subtotal	Gen Con	GC OVHD	Conting	Total	CSI Total
15 Mechanical									**$9,246**
Fire Suppression: Wet System	3000	sf	$2.00	$6,000	$420	$1,284	$1,542	$9,246	
Adapt the original heating system for limited, seasonal use.	Allowance by owner.								
Install a propane heating unit in the basement.	Allowance by owner.								
Reopen the chimney and historic stovepipe openings for use as a distribution system.	Allowance by owner.								

	Qty	Unit	Cost/Unit	Subtotal	Gen Con	GC OVHD	Conting	Total	CSI Total
16 Electrical									**$0**
Install minimal lighting to insure visitor safety, with switches and fixtures in visually non-obtrusive locations.	Allowance by owner.								
Security/fire alarm system.	Allowance by owner.								
DUPLEX KEEPERS' DWELLING (HS-11) TOTAL									**$51,915**

TOWER (HS-10)

	Qty	Unit	Cost/Unit	Subtotal	Gen Con	GC OVHD	Conting	Total	CSI Total
15 Mechanical									**$308**
Fire Suppression: Wet System	100	sf	$2.00	$200	$14	$43	$51	$308	
TOWER TOTAL									**$308**

FOG SIGNAL BUILDING (HS-16)

	Qty	Unit	Cost/Unit	Subtotal	Gen Con	GC OVHD	Conting	Total	CSI Total
2 Site Construction									**$10,468**
Grading and paving for UFAS compliant access.	1	ea	$1,500.00	$1,500	$105	$321	$386	$2,312	
Remove existing asphalt shingles and properly dispose of them offsite.	2300	sf	$0.49	$1,127	$79	$241	$290	$1,737	
Remove areas of deteriorated sheathing.	500	sf	$0.33	$165	$12	$35	$42	$254	
Remove interior debris and equipment which will not be part of the interpretive program.	1	tot	$1,500.00	$1,500	$105	$321	$386	$2,312	
Clean interior masonry surfaces.	2500	sf	$1.00	$2,500	$175	$535	$643	$3,853	
Lead Abatement	Allowance by owner								

	Qty	Unit	Cost/Unit	Subtotal	Gen Con	GC OVHD	Conting	Total	CSI Total
4 Masonry									**$462**
Repair failed mortar joints at jack arches over each of the door openings.	3	ea	$100.00	$300	$21	$64	$77	$462	

Qty	Unit	Cost/Unit	Subtotal	Gen Con	GC OVHD	Conting	Total	CSI Total

	Qty	Unit	Cost/Unit	Subtotal	Gen Con	GC OVHD	Conting	Total	CSI Total
6 Wood and Plastics									**$8,862**
Restore all exterior wood surfaces, including window frames, doors, eaves, and dormer by removing paint to bare wood or sound paint surface.	350	sf	$12.00	$4,200	$294	$899	$1,079	$6,472	
Consolidate or repair wood elements where necessary.	100	sf	$8.00	$800	$56	$171	$206	$1,233	
Replace missing door and window hardware with historically appropriate elements.	15	ea	$50.00	$750	$53	$161	$193	$1,157	

	Qty	Unit	Cost/Unit	Subtotal	Gen Con	GC OVHD	Conting	Total	CSI Total
7 Thermal and Moisture Protection									**$73,660**
Replace deteriorated sheathing.	100	sf	$8.00	$800	$56	$171	$206	$1,233	
Install new, pre-painted, metal shingles to match the original style and size.	2350	sf	$20.00	$47,000	$3,290	$10,058	$12,079	$72,427	

	Qty	Unit	Cost/Unit	Subtotal	Gen Con	GC OVHD	Conting	Total	CSI Total
9 Finishes									**$65,339**
Prime and paint exterior wood surfaces in accordance with the historic paint analysis.	350	sf	$8.00	$2,800	$196	$599	$720	$4,315	
Scrape interior metal to bare metal or sound surface. Apply rust-inhibitive primer and paint in accordance with the historic paint analysis.	150	sf	$8.00	$1,200	$84	$257	$308	$1,849	
Prime and paint the interior masonry surfaces in accordance with the historic paint analysis.	2500	sf	$8.00	$20,000	$1,400	$4,280	$5,140	$30,820	
Prime and paint metal shingles prior to installation.	2300	sf	$8.00	$18,400	$1,288	$3,938	$4,729	$28,355	

	Qty	Unit	Cost/Unit	Subtotal	Gen Con	GC OVHD	Conting	Total	CSI Total
15 Mechanical									**$2,836**
Fire Suppression: Wet System	920	sf	$2.00	$1,840	$129	$394	$473	$2,836	

	Qty	Unit	Cost/Unit	Subtotal	Gen Con	GC OVHD	Conting	Total	CSI Total
16 Electrical									**$12,173**
Electrical Wiring	1100	sf	$3.00	$3,300	$231	$706	$848	$5,085	
Ceiling mounted light fixtures	8	ea	$250.00	$2,000	$140	$428	$514	$3,082	
Duplex outlets	16	ea	$100.00	$1,600	$112	$342	$411	$2,465	
Electrical Distribution Panel	1	ea	$1,000.00	$1,000	$70	$214	$257	$1,541	

FOG SIGNAL BUILDING TOTAL **$173,800**

BRICK OIL HOUSE (HS-13)

	Qty	Unit	Cost/Unit	Subtotal	Gen Con	GC OVHD	Conting	Total	CSI Total
2 Site Construction									
Lead Abatement	Allowance by owner								

	Qty	Unit	Cost/Unit	Subtotal	Gen Con	GC OVHD	Conting	Total	CSI Total
4 Masonry									**$1,233**
Tuckpoint as needed, particularly at the north elevation.	100	sf	$8.00	$800	$56	$171	$206	$1,233	

	Qty	Unit	Cost/Unit	Subtotal	Gen Con	GC OVHD	Conting	Total	CSI Total

	Qty	Unit	Cost/Unit	Subtotal	Gen Con	GC OVHD	Conting	Total	CSI Total
6 Wood and Plastics									**$901**
Seal open cornice joints.	10	lf	$8.00	$80	$6	$17	$21	$124	
Consolidate deteriorated wood at eaves and cornice.	36	lf	$14.00	$504	$35	$108	$130	$777	
9 Finishes									**$703**
Sand, prime and paint wood trim.paint Brick Oil House roof	36	sf	$8.00	$288	$20	$62	$74	$444	

Scrape metal door to bare metal or sound surface, prime and paint.	21 sf	$8.00	$168	$12	$36	$43	$259	

BRICK OIL HOUSE TOTAL **$2,837**

METAL OIL HOUSE (HS-12)

	Qty	Unit	Cost/Unit	Subtotal	Gen Con	GC OVHD	Conting	Total	CSI Total
2 Site									**$0**
Lead Abatement	Allowance by owner								
Historic Paint Color Analysis	Allowance by owner								

	Qty	Unit	Cost/Unit	Subtotal	Gen Con	GC OVHD	Conting	Total	CSI Total
9 Finishes									**$4,931**
Remove rust, prime, and finish Metal Oil House exterior in accordance with historic paint analysis.	400	sf	$8.00	$3,200	$224	$685	$822	$4,931	

METAL OIL HOUSE TOTAL **$4,931**

BRICK PRIVIES (HS-14, HS-15)

	Qty	Unit	Cost/Unit	Subtotal	Gen Con	GC OVHD	Conting	Total	CSI Total
4 Masonry									**$1,233**
Tuckpoint as needed.	100	sf	$8.00	$800	$56	$171	$206	$1,233	

	Qty	Unit	Cost/Unit	Subtotal	Gen Con	GC OVHD	Conting	Total	CSI Total
6 Wood and Plastics									**$3,453**
Consolidate deteriorated wood at eaves and cornice.	60	lf	$14.00	$840	$59	$180	$216	$1,295	
Construct new wood cleanout covers.	2	ea	$200.00	$400	$28	$86	$103	$617	
Restore doors.	2	ea	$500.00	$1,000	$70	$214	$257	$1,541	

BRICK PRIVIES TOTAL **$4,686**

BOAT HOUSE (HS-17)

No recommendations at this time.

PROJECT TOTAL **$1,221,455**