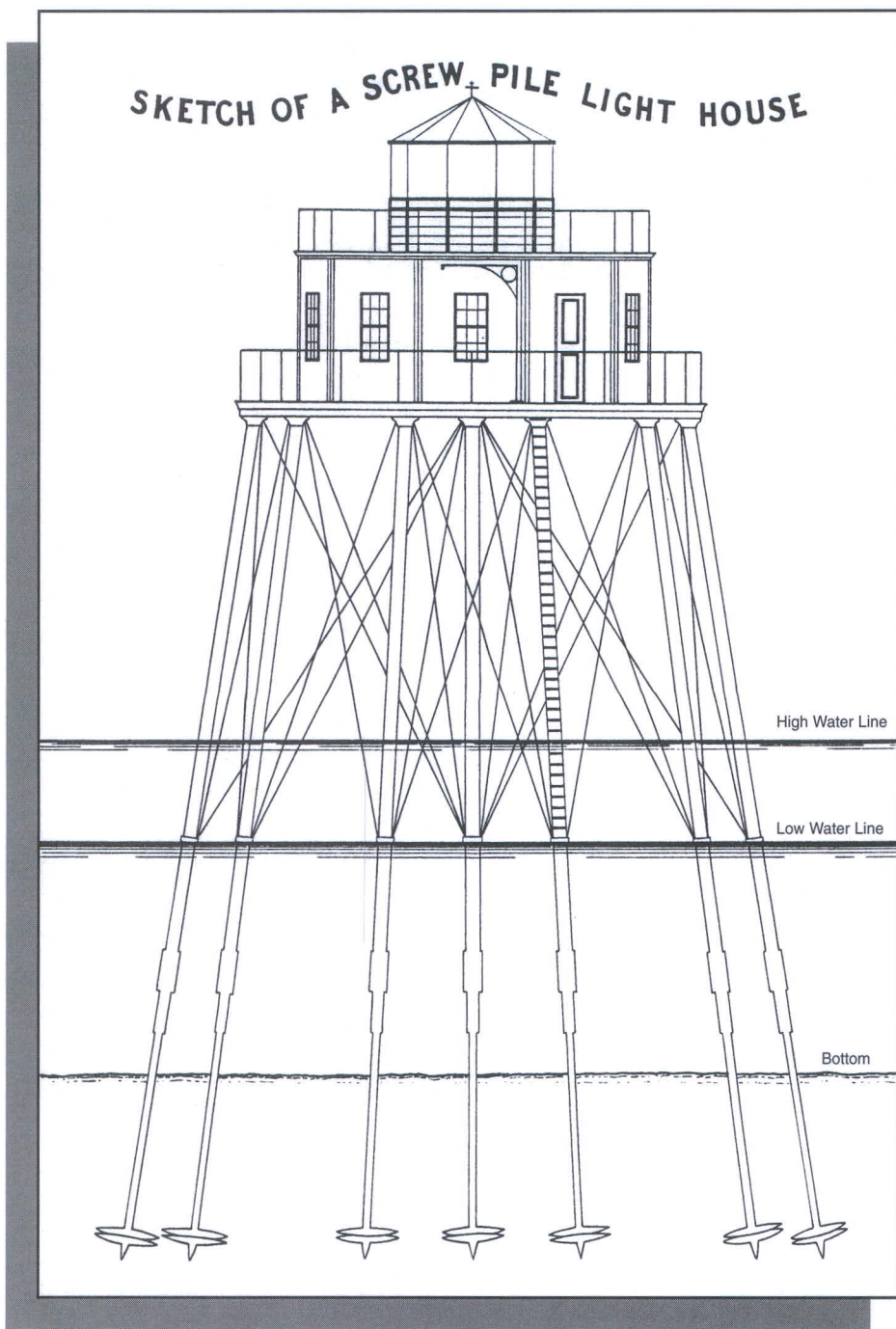


AMERICA'S A LIGHTHOUSE FOR BRANDYWINE SHOAL FIRST SCREW-PILE

By Wayne C. Wheeler



Since the Colonial period, one of the major waterways on the eastern seaboard has been the Delaware Bay and River. The Bay and River, separating New Jersey from Pennsylvania and Delaware, stretches from the mouth all the way to Philadelphia, Camden and Trenton. Prior to the completion of the Erie Canal in 1825, which elevated New York City to a major port, Philadelphia and Boston were the primary seaports of the colonies and our new nation. One of the twelve colonial lighthouses was situated at Cape Henlopen, on the south side of the entrance to the Bay.

The mouth of Delaware Bay is laced with shoals and sand bars with colorful names like Inner Fork of Shears, Egg Island Flats, Crow Shoal, and Joe Flogger. One of the most dangerous is Brandywine Shoal, situated in the center of the Bay, about 12 miles west of the mouth. To protect vessels plying the waterway, a light boat was anchored at the shoal in 1823 and served at that location until 1850, when the lighthouse was constructed. The light boat, designated "N" (lightships started to be numbered in 1837), was one of the very first constructed in this country. It's described as being 72 feet in length and weighing 120 gross tons. The vessel displayed a fixed light from each of her two masts.

In 1838, Naval Lt. William Porter made an inspection of aids to navigation in the 4th Lighthouse District. Regarding the Brandywine Shoal vessel he wrote, "Fifteen years old; very much out of order, requires thorough repairs. The cause of rot in our light-vessels can be attributed to the following causes: want of care and proper ventila-

tion, and the mephitic vapor arising from bilgewater. All causes can be obviated by the use of common windsail [ventilator] and the inverted bellows, as used on board of the vessels of the Navy, which has proved of decided benefit in expelling the noxious vapors arising in a ship's Hold."

An 1844 Report by the local Superintendent states, "This floating light is well kept and shows a good light. The vessel is rotten, and has been condemned as unworthy of repair; but is in good order and well kept. The oil is good, the keeper sober and competent." Interestingly, when a lighthouse was constructed on Brandywine Shoal in 1850, the now 27-year-old vessel was transferred to Massachusetts to mark Minots Ledge after the lighthouse on that ledge was destroyed in an 1851 storm. In 1855, light boat *N* relieved the lightship on the Cross Rip station and later assumed the Five Fathom Bank station. This poor old "rotten" lightship or light boat wasn't retired until 1859, after 36 years of service.

Moving ice floes prevented the light boat from maintaining station during the winter months. The Lighthouse Service attempted to solve the problem in 1827 by constructing a wooden pile structure. Congress appropriated \$29,200 for the project and stated, "...and, also, that when the Brandywine Lighthouse

shall be lighted, the Brandywine light-vessel, if the same will answer the purpose, shall be anchored at or near, Tuckanuck Shoal in the Vineyard Sound." However, the lighthouse was damaged by the sea in 1827, before its completion. The following year, \$10,000 was authorized for preserving and securing the structure. This corrective measure only lasted twelve months — the lighthouse was destroyed by the sea. The government had spent \$1,080,000 in today's money for a structure which lasted one year.

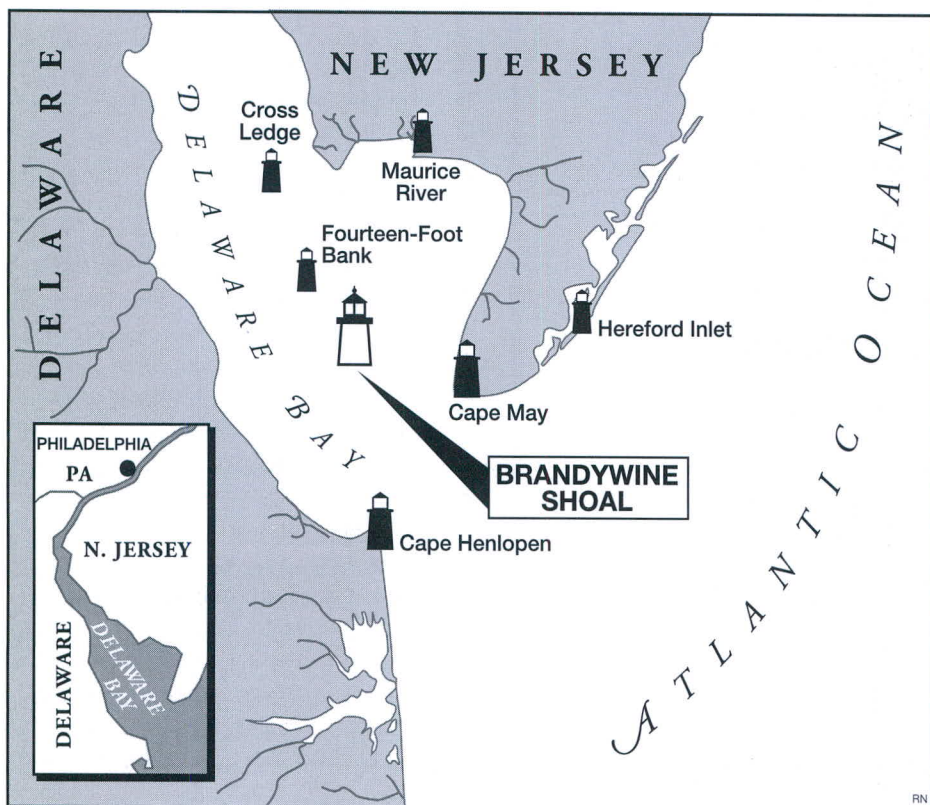
In 1834, Congress again authorized funds "For rebuilding the light-house on Brandywine Shoals, in the bay of Delaware, thirty thousand dollars: PROVIDED, however, that before the commencement of the work a resurvey, plan, and estimate shall be made, and then it shall be in the discretion of the proper department to enter upon the rebuilding of said light-house, or to report such survey, plan, and estimate to Congress as shall be considered best for the public interests." Having been burned for \$1 million once, Congress wanted to ensure the second \$1 million would deliver a structure which would last.

In 1835, Major Hartman Bache, Topographical Engineers, studied the situation and submitted a report to his superior, Lt. Col. J.J. Albert.

"Sir: The following report, with a plan and estimate for a light-house on the Brandywine Shoal, Delaware Bay, made in obedience to the instructions of the bureau of 11 October last, is respectfully submitted.

"The Brandywine Shoal is situated at about ten miles within the capes, in the widest part of the bay, and forms, with Brown Shoal, the entrance into the main ship channel. To strike [enter] this channel constitutes the greatest difficulty for inward bound vessels in the navigation of the Delaware, and it is to lessen the difficulty that it is proposed to erect a light-house on the first named shoal."

Major Bache (who would later survey the first sites for lighthouses on the West Coast) went on to describe the dangerous cross currents and decisions a navigator must make to safely transit the area. He reasoned that although it was necessary to position the lighthouse correctly, it was also desirable to place it where it had a chance of surviving, especially with the large sum to be spent. He mentioned that the greatest danger came from ocean swells. The six-mile-long shoal is about four feet deep in the middle at low water, and slopes away in both directions to a depth of 24 feet at two miles from the shallowest point. Bache's recommendation was to find a location that was, (1) a point least exposed to the action of the greatest swells, (2) an area where the bottom was least disturbed by currents and (3) had the best soil to sustain the works. His selected site was on the channel side of the shoal about midway from front to back, an area where the water was 12 feet deep. He proposed to construct a turtle back foundation of stone upon which to place the lighthouse. The foundation would be seven feet under water at low tide. An elliptical building, 33 by 22 feet, would be constructed on this foundation with a height of 44 feet above high water. Bache estimated that "...the light would be visible from the deck of small vessels, and under the least favorable stage of tide, about ten miles...a greater distance is not desirable, as the light might cause confusion [with others] when approaching the coast. He estimated the cost at \$123,874.60, a very large sum for that era. Structures such as a screwpile or caisson foundation would have been less costly. However, the screwpile wasn't invented until 1838 and the first caisson wasn't constructed until 1871 (Duxbury Pier, near Plymouth, MA).



On February 6, 1836, the Secretary of War submitted a letter to the Committee on Commerce;

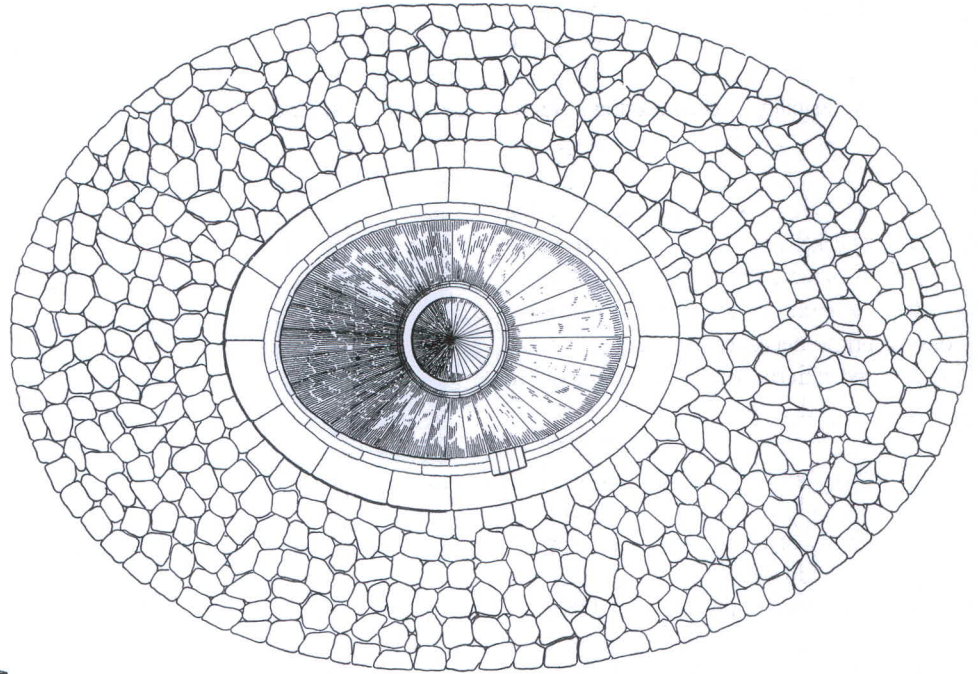
“SIR: I have the honor to transmit a communication from the Topographical Bureau, with a copy of the survey, plan, and estimate for re-building the light-house on Brandywine shoals, as required by the act of Congress of June 30, 1834, making appropriations for building light-houses, &.”

Very respectfully,
Your most obedient servant
Lew. Cass

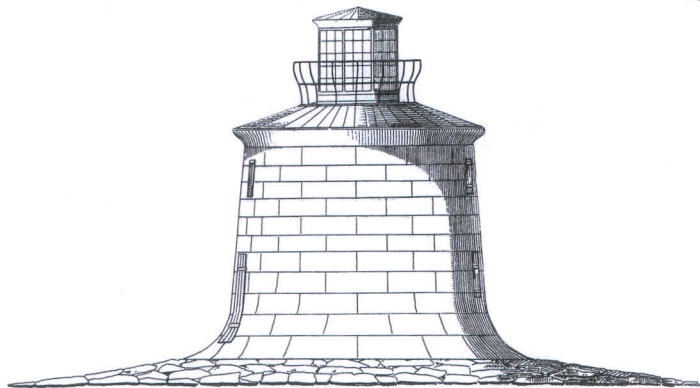
LIGHT HOUSE
proposed for the
BRANDYWINE SHOAL,
DELAWARE BAY.

Plan & elevations of
LIGHT HOUSE.

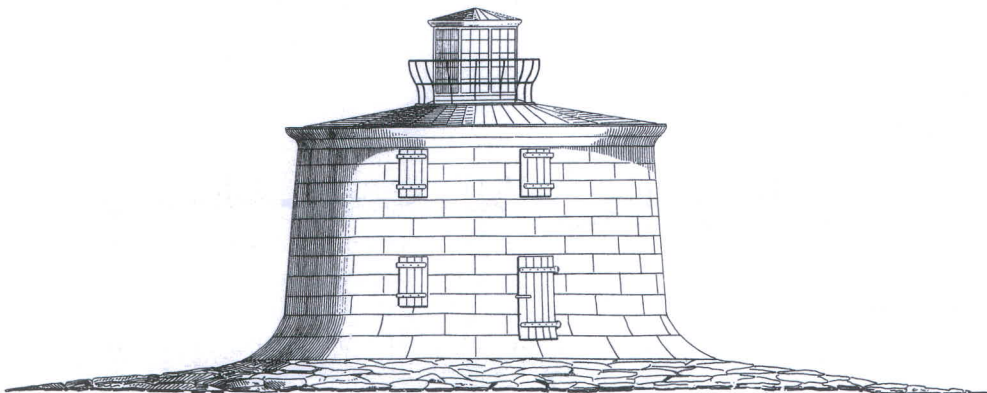
Hartman Bache Br. Maj. & Topog^l Eng^r



These drawings for the proposed light-house on Brandywine Shoal were never executed. The Lighthouse Service opted for the screw-pile design instead.



End Elevation



Side Elevation

In March 1837, an appropriation was made by Congress, “...in addition to the sum already appropriated, fifteen thousand dollars, agreeably to the plan and estimate made by Hartman Bache, of the engineer corps...” This was in addition to the \$30,000 appropriated in 1834.

Ten years had passed since the Brandywine Lighthouse was destroyed, and five years since funds had been appropriated for its reestablishment. Bache's superior, Colonel J.J. Albert, was dubious about Bache's plan. In a report to the Secretary of War, J.C. Spencer, he expressed his concerns. He talked about the \$124,000 estimate and noted that \$84,500 was just for the artificial island part of the plan and that, “the report only gives the estimate as an ‘approximate’ one, and intimates that, in consequence of the nature of the locality, and the unforeseen and unavoidable contingencies under which the expenditures must be made, the estimate may not be ‘borne out in the result.’” Albert also stated that a more elaborate survey of the

area in 1839, four years after Bache's work, resulted in a project estimate of \$178,416, a whopping 44% increase and no guarantee that the project would be successful. In today's money this represents \$4.3 million. Albert noted that of the total \$45,000 appropriated to date, \$35,448 had been expended on the survey, construction of a caisson and stone for the artificial island. The balance was carried to the surplus fund in 1840.

Apparently, a similar artificial island/light-house project had been developed concurrently on Flynn's Knoll off Sandy Hook, New Jersey and it had failed. This report also mentions the possibility of constructing a screw-pile type structure for the first time: "...it appears to the committee that the Brandywine shoal is a good locality for a screw-pile lighthouse. The depth of the water and the character of the bottom seem to invite this mode of structure. The work is one of prime necessity: so conceded by all acquainted with the locality. If the house is to be built on the old plan, then \$100,000 should be appropriated. A less sum expended in one season would leave the work to sympathize with the water logged brush with Flynn's Knoll." He stated that a screwpile structure could be constructed for less than the original plan and recommended that the screwpile plan be printed as an annex to his report if the cost of including such plans didn't exceed \$75 printing costs.

Albert's superior, Captain W.H. Swift, forwarded Albert's report and noted, "...I have stated that forty-thousand dollars would be required for the light[house] and for the necessary protection against the ice. The screw-pile light itself has been abundantly tested; there is no doubt of its entire success; and I feel the fullest confidence in the adequacy of the estimate. The protection of the same against ice is an **experiment** which we have to make; and I should be very sorry to see it fail for the want of five or ten thousand dollars, more or less." He requested \$45,000 for the project, to cover contingencies and the ice protection and stated, "...I think the bureau of the corps of topographical engineers...would find the means to execute successfully this first attempt to introduce the 'screw-pile light' upon our coast."

In a report to Congressman John McKeon, Swift reported –

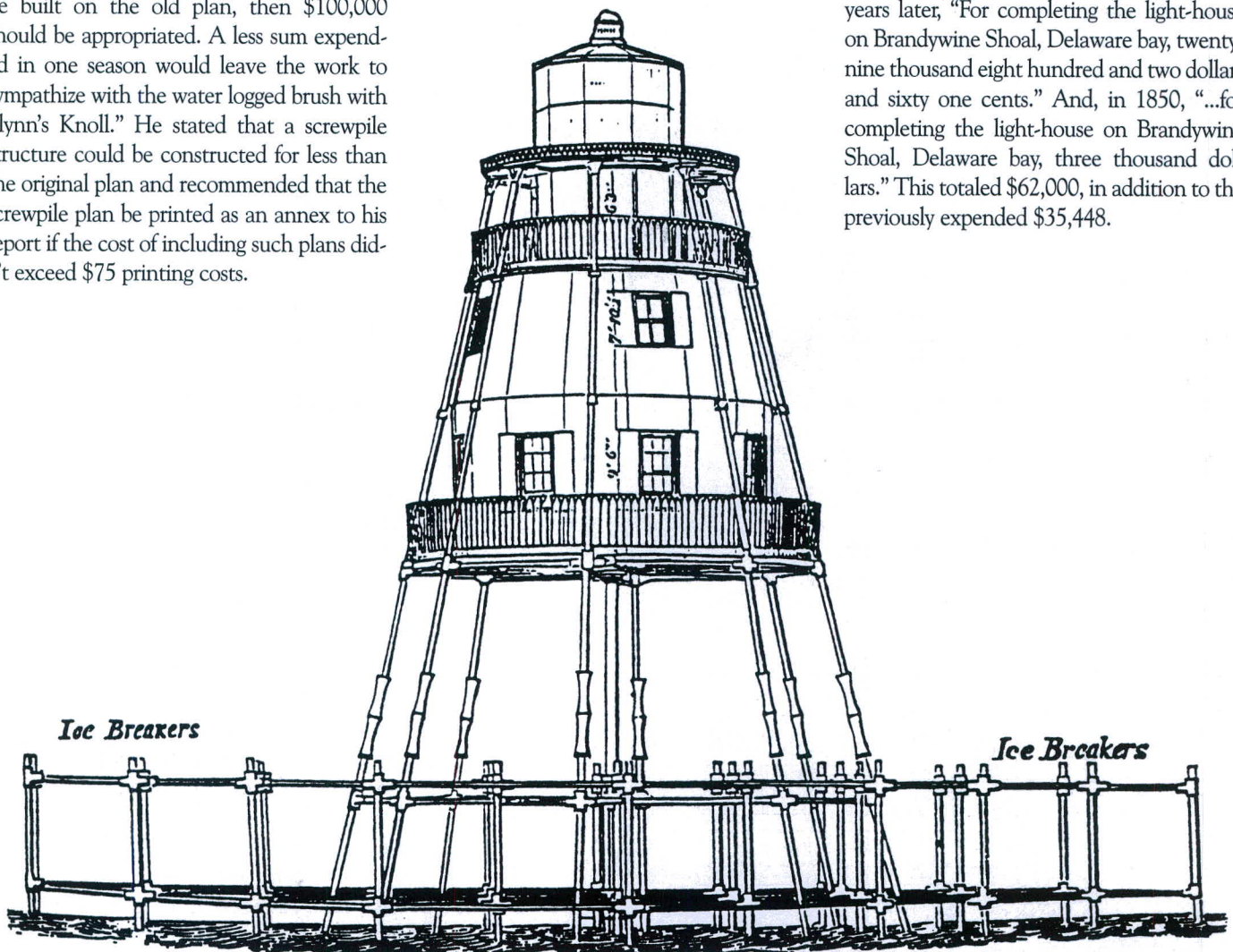
"1. That the principal of the 'Mitchell's mooring screw' has been successfully applied in England in establishing foundations for light-houses upon sand-shoals and spits, in situations exposed to a heavy sea, and where other modes of construction have been considered impracticable, arising from the unstable nature of the bottom to be built upon.

2. That it can be constructed at a small cost, as compared with that of other modes...

3. That it can be erected in a much shorter period of time than any other.

4. That it produces no sensible change in the shape or surface of the bar or shoal, by which the stability of a stone structure might be endangered."

Congress approved the experiment to construct a screwpile on the Brandywine Shoal by appropriating \$30,000 in 1847, "...to continue the construction of the light-house on Brandywine Shoal..." And, two years later, "For completing the light-house on Brandywine Shoal, Delaware bay, twenty-nine thousand eight hundred and two dollars and sixty one cents." And, in 1850, "...for completing the light-house on Brandywine Shoal, Delaware bay, three thousand dollars." This totaled \$62,000, in addition to the previously expended \$35,448.



The structure, painted red, was completed in 1850 and a 3rd order Fresnel lens was installed, displaying a fixed white light. It was the third lighthouse in this country to receive the improved apparatus. \$1,144 was appropriated for the trial and maintaining of the light on Brandywine Shoal from October 1, 1850 to March 31, 1851. The following year \$3,600 was appropriated to construct two ice breakers to protect the lighthouse.

In 1851, the ad hoc Lighthouse Board, upon investigating the Brandywine Shoal Light Station, reported, "This is a light-tower erected upon iron screw-piles for a foundation, under the direction and management of Major Hartman Bache, of the corps of United States topographical engineers." The report stated it was one of the most difficult sites that could have been selected, and:

"The tower is illuminated by a beautiful specimen of a third order...lens, or Fresnel apparatus, constructed by M. Henry LePaute of Paris...The burner [lamp] is composed of two concentric wicks...this beautiful specimen of mechanism was found to be in fine order and well cared for: it was impossible to detect a single scratch or fracture in any part of the apparatus...The principal keeper...took charge of the light on the 28th of October, 1850...without having had the advantage of previous instruction in the management of the carcel lamp, and found difficulty in keeping a brilliant and powerful light at first, but has none [difficulty] now.

"Three persons are allowed to assist the keeper in charge of this establishment, more especially to enable him to communicate by boat with the shore and with the pilot-boats, which frequently approach the light, to aid him in getting provisions, etc...with a proper system of ventilation, superintendence, the number of persons attached to this isolated position might be lessened, without detriment to the service; but so long as keepers are compelled to provide themselves with rations for a position so difficult of approach for a great portion of the year as this is, (it happening very often that all communication is cut off for weeks at a time from the shore) it will be necessary to keep a boat's crew stationed at this light.



The 1850 Brandywine Shoal Lighthouse superstructure in 1910. National Archives photo courtesy of Jim Gowdy. Jim's fine book on the lighthouses of Delaware Bay should be published any day. Watch for a review in the *Log*.

"The keeper, with his assistants, keeps a regular watch during the night...the lantern is fitted with thick, clear French plate glass 30 by 32 inches [far larger than the standard 9 by 12 inch panes in use at that time]...regular reports are made to Major Bache, (who was in charge of the work) of the changes in the bottom under the structure, and of consumption of oil...This establishment is furnished with all the necessary tools and appliances for repairing the lamps, a barometer, thermometer, a clock, water filter and medicine cabinet...A fog bell weighing 500 pounds...is attached to this light, which is struck by a clock-work movement...seven times in thirty seconds."

The report noted that the lighthouse was fitted up with "utmost care" and detailed the numerous water and fuel tanks, the new style boat davits for hoisting the station boat and that, "The keeper of this light deserves great praise for the manner in which he keeps it: especially when it is remembered, that at the time of his taking charge of it he never saw a mechanical lamp."

Then the ad hoc board conducted an experiment. Leaving the Brandywine Shoal Lighthouse, the inspection board proceeded by boat to a point 15 miles from Brandywine Shoal (with its 3rd order lens) and a point 6 1/4 miles from the Cape Henlopen (DE) Lighthouse (with its fixed apparatus of 18 twenty-one inch reflectors and lamps 72 feet above sea level), and 8 3/4 miles from the Cape May Lighthouse (with a revolving system of 15 sixteen inch reflectors and lamps, 75 feet above sea level).

"These three lights having been watched by the members of the Board... [who] came to the conclusion, without difficulty, that the third order lens light on the Brandywine Shoal, with an elevation of only forty-five feet, was more brilliant at the distance of fifteen miles (nearly its greatest range) than either the fixed light of the first class reflector lights on our coast at the distance of six and one-fourth miles, or the revolving reflector light at Cape May, intended to be a first class seacoast light, at a distance of 8 and three-quarter miles."

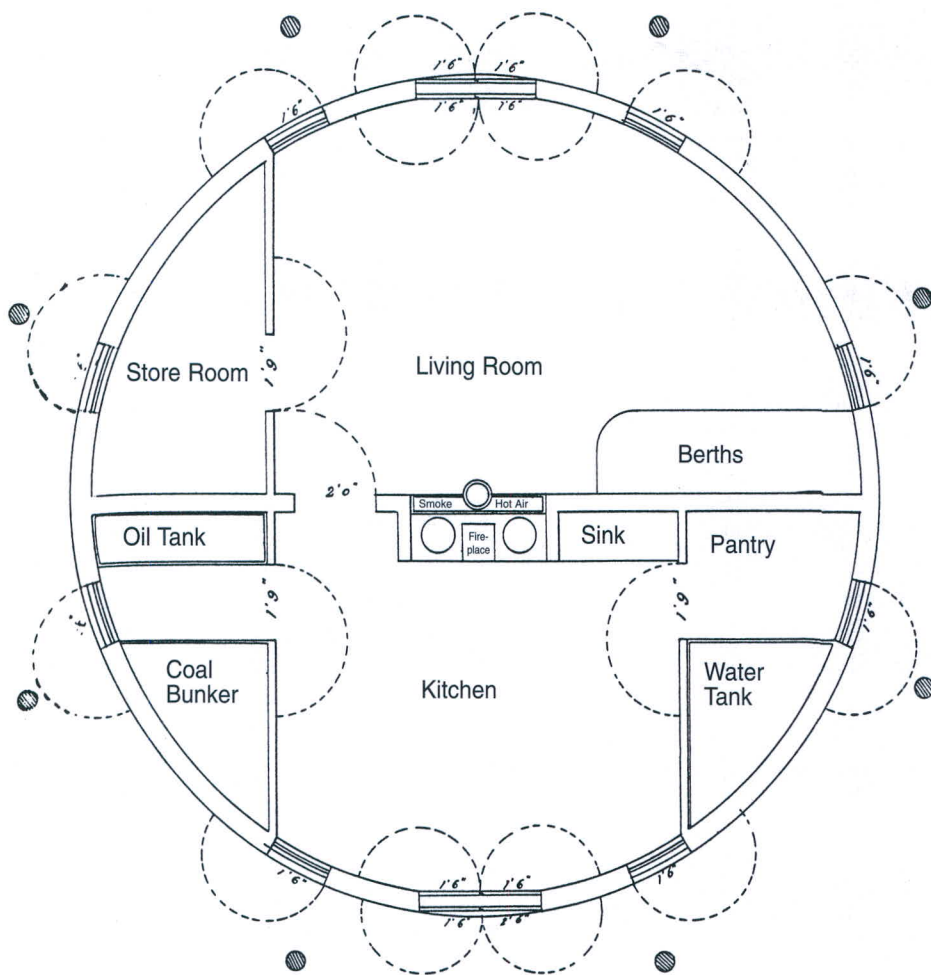
The report went on to discuss the advantages of the Fresnel lens; the savings of oil, by having just one lamp at Brandywine in lieu of several lamps required in the reflector system, and the attendant savings of wicks and chimneys, cleaning cloths, buffers, etc. They ended their report on the Brandywine inspection by stating, "It may be remarked, that the only three stations at which lens lights [Fresnel lenses] have been placed [Navesink, NJ; Sankaty Head, MA and Brandywine Shoal], Congress passed special laws providing them; while England, Scotland, Ireland, and the continental states of Europe generally have, during the last fifteen years, adopted the French system of illumination as rapidly as renovations could be...made...and...new light-houses established."

It is worth noting that this 1851 report, a 760-page volume, was authorized by Congress due to numerous complaints about the administration of lighthouses in the United States. Stephen Pleasonton, the Fifth Auditor of the Treasury, had directed the Lighthouse Service since 1820. Extremely frugal and stubborn, he consistently refused to accept the improved Fresnel system.

We have discussed Pleasonton in earlier Logs and won't go into great detail, but the men who conducted the inspections and authored this report became, in 1852, the U.S. Lighthouse Board. They improved our country's system of aids to navigation over the next 58 years. One of their first acts was to install Fresnel lenses in all American lighthouses, with the exception of some range lights.

The Brandywine Shoal saga is instrumental as a primary turning point in the way our nation maintained our aids to navigation. It was the site of one of the earliest lightship (or light boat) stations, the site of the first screwpile lighthouse in this country (eventually numerous screwpile structures would be established in Chesapeake Bay, North Carolina and along the Gulf Coast), the third lighthouse in America to receive a Fresnel lens and, in 1914, the site of the last caisson lighthouse constructed in the country (along with Thimble Shoal, VA).

Left — The layout of the 1st floor of the 1850 Brandywine Shoal Lighthouse, as designed by I.W.P. Lewis in 1848. The outside dots represent the locations of the foundation piles. National Archives drawing courtesy of Jim Gowdy.





The new and old Brandywine Shoal Lighthouses in 1933. Photo courtesy of R.C. Smith.

The New Brandywine Lighthouse

At the dawn of the twentieth century the Brandywine structure was showing a lot of wear. Additionally, it was becoming increasingly more expensive to maintain.

The ice protection fender system was inspected in 1873. The inspection proved the structure to be battered in some places and wasted in many areas. Although the piles of the lighthouse foundation itself showed little wasting, some erosion was occurring and some areas around the piles were scoured.

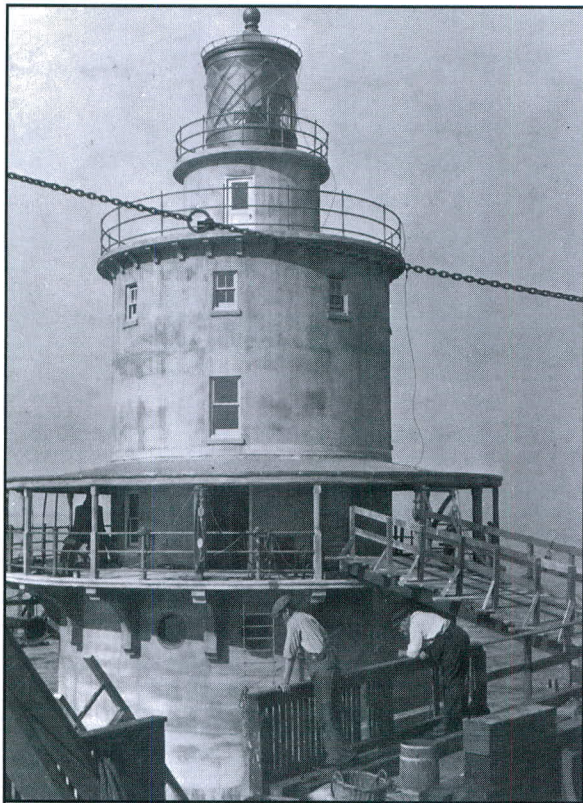
An Act of 1911 appropriated \$75,000 for "rebuilding and improving the light at Brandywine Shoal on the present or adjacent site." A contract was entered into for a reinforced concrete lighthouse with a completion date of June 1914.

The concrete caisson foundation was launched at Lewes, Delaware on July 10, 1913, and towed to the site. It was placed on a (driven) pile foundation adjacent to the old structure (about 50 feet away) on August 6, 1913. Work was suspended for the winter in November.

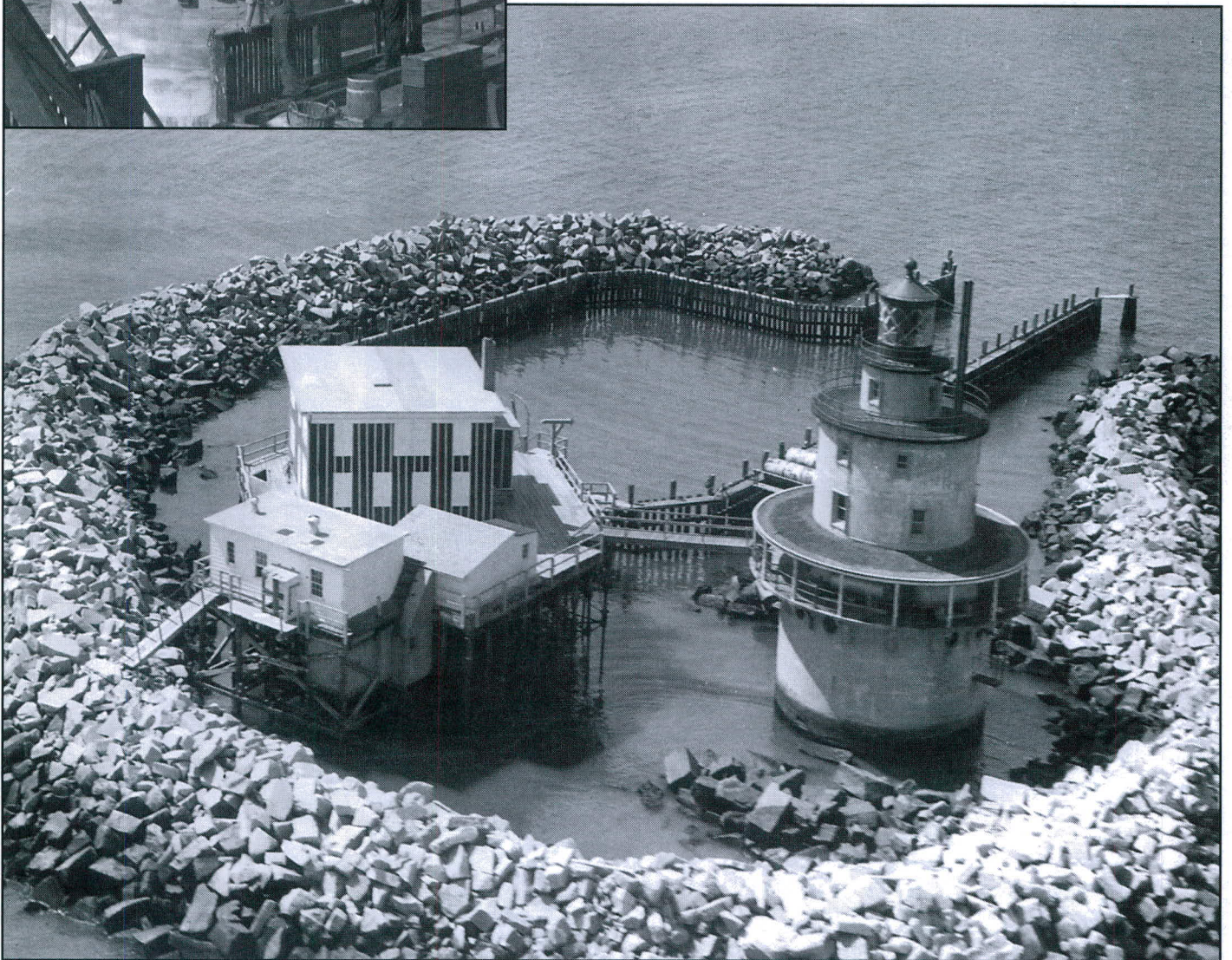
In May 1914, the contractor resumed work, installing the first floor beams and slabs and constructing the outside circular wall up to the second floor. The project was completed on November 1, 1914, at a total cost of \$74,960.34 — \$39.66 under budget. The Fresnel lens was transferred from the original structure, and the new lighthouse became operational on October 20, 1914. The superstructure of the original Brandywine lighthouse was removed as far as the pilings. A

platform was placed on the pilings, upon which three construction buildings were erected, apparently for the crew constructing a wall of rip-rap stone around both structures. This wall formed a small sheltered harbor. The construction buildings were subsequently used by the U.S. Navy in the 1940s and 1950s. In later years both the structures and original screw-piles were removed.

Brandywine was the last manned lighthouse on Delaware Bay. It was automated in 1974. Due to the solarization of the 1914 structure, the Fresnel lens was removed from the lighthouse in 1997 and was given to the Baymen's Museum of Tuckerton, New Jersey, for eventual display in the replica of Tucker's Island Lighthouse which it hopes to build at the planned Tuckerton Seaport.



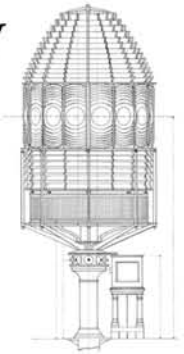
Left — Workers finishing construction of the new Brandywine Shoal Lighthouse. Note the diagonal astragals of the lantern room (an English design) and the large fog bell on the gallery deck at left. 1914 photo courtesy of R.C. Smith.



The Brandywine Shoal Lighthouse was eventually surrounded with protective rip-rap. In this photo the superstructure of the screw-pile lighthouse has been removed, but modern buildings to house Coast Guard personnel have been constructed on the old foundation. 1952 U.S. Coast Guard photo.



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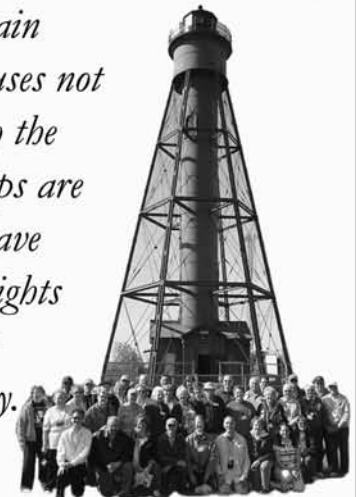
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