Block Island Southeast Light
Spring Street and Mohegan Trail
at Mohegan Bluffs, Southeast Point
Block Island
Washington County
Rhode Island

HAER No. RI-27

HAER
RI,
5-NESH,
1-

PHOTOGRAPHS
REDUCED COPIES OF MEASURED DRAWINGS
WRITTEN HISTORICAL AND DESCRIPTIVE DATA

Historic American Engineering Record
National Park Service
Department of the Interior
Washington, DC 20013-7127

HAER RI, 5-NESH, 1-

HISTORIC AMERICAN ENGINEERING RECORD

BLOCK ISLAND SOUTHEAST LIGHTHOUSE

HAER NO. RI-27

Location: Spring Street and the Mohegan Trail at Mohegan Bluffs, at the Southeast point of Block Island, New Shoreham, Washington County, Rhode Island.

Date of Erection: Plans for the construction of the Block Island Southeast Light were approved in 1873, although evidence suggests that construction did not begin until 1874. The lighthouse was completed and first lit on February 1, 1875. A major change was made in the lens assembly in 1929.

Present Owner: U.S. Coast Guard; currently leased by the Block Island Southeast Light Foundation, Inc.

Present Use: Manned aid to navigation.

Significance: The Block Island Southeast Lighthouse is significant as a primary aid to the navigation of an otherwise dangerous area, once referred to as the "stumbling block" of the New England coast. It marks the first island landfall for ships approaching New England from the south or southeast. It was the second light to be built on the island and the first on the south side. At the time of its completion in 1875 it was considered to be one of the finest and best equipped lighthouses on the east coast, featuring a first order Fresnel lens, the best in lighting apparatus technology. The lighthouse is also of significance for its interesting design, a melding of Gothic Revival and Italianate styles taking form in an octagonal tower.

Historian: Mary M. Thomas

Editors: Catherine C. Lavoie, Historian
& Richard K. Anderson, Jr., Architect
Historic American Engineering Record
National Park Service
Summer 1988

Sailing off the coast of New England, the sun sinks slowly in the western sky, and darkness falls. Night sailing on America's northeastern coasts is relatively safe due to the great number of lighted aids to navigation under the jurisdiction of the U.S. Coast Guard. Therefore, the nocturnal sailor worries little as he scans the horizon for fixed or flashing lights that will guide him away from treacherous shoals and islands. The Block Island Southeast Light on the southeastern tip of Block Island, Rhode Island, will help to guide the sailor around that small land mass, known for centuries as the "Stumbling Block" of the New England coast. Viewing the Southeast Light in conjunction with other area lights, the night-time mariner can easily plot a course north towards Martha's Vineyard, or inland by way of Long Island Sound.

But imagine that our sailor's trip becomes more complicated as he sails along; a fog bank rolls into the area, obscuring the various lights along the northeastern seaboard and leaving our sailor open to the possibility of running aground. How can he proceed safely? Suddenly, a deep bass blast of a fog-signal is heard. Fortunately for many sailors caught in this situation, the Coast Guard provides more than just lighted beacons for surface navigation. Installed at most light stations and on buoys are sonic devices such as fog horns, sirens, and bells that will guide ships during inclement weather when the lighted beacons become invisible. Further aids to navigation, such as radio beacons, will also alert vessels to their positions in any type of weather.

All of the above-mentioned aids to navigation are present at the Block Island Southeast Light. In an age when the vast majority of lighthouses have been replaced by automated beacons, the Southeast Light still uses a late-nineteenth century first-order Fresnel lens and is cared for by Coast Guard personnel. The structure, which dates back to 1875, is representative of late nineteenth-century lighthouse architecture, as designed by the U.S. Lighthouse Board. Its accompanying light apparatus, with its Fresnel lens and all the latest updates in lighting technology, reflects the evolution of lens apparatus engineering. Thus, the Block Island Southeast Lighthouse is historical significance in a number of ways: as an example of the progress made in light technology, its role in the maritime history of the New England coast, and for its interesting architectural design.

This lighthouse is one of the last of the manned lighthouses in the United States. As of the summer of 1988 only nine lighthouses operated by the United States Coast Guard remained unautomated. The Southeast Light offered the unique opportunity to record a first order sea coast historic light structure and its associated technology, still in use today. The lens apparatus

displays a now rare combination of new technology incorporated into a much older technology: a modern-day quartz-iodide electric lamp is used in conjunction with lenses, some of which date from the late 1800s. The modern lenses are made of plastic, although they are based on the same optical principles as the older lenses. The U.S. Coast Guard has, however, made plans to build an automated light tower on the site in the fall of 1988.

The first impression one gets of the lighthouse is of awe, particularly if the first encounter is at night. Approaching Block Island by ferry in the evening, curiosity is aroused by a flashing green light seen on a high point in the distance. A two-mile long road winds its way south from the ferry dock, occasionally passing in sight of the ocean. It leads to the rear of the lighthouse, where the imposing structure sits 150 feet above the waves on the Mohegan Bluffs, incorporating a tower which raises the total to a height of 212 feet above sea level. As the sky grows dark, the observer will see eight revolving beams of green light radiating from the lantern room at the top of the tower, appearing as the spokes of a giant wheel extending out to the sea.

Over the years, the Southeast Lighthouse's picturesque architectural style and setting have inspired many artists. It has also appeared on many tourist souvenirs since its completion in 1875, and is among the most photographed lighthouses in New England. But what lies behind the outward appearance of the site; what was there and how did it work? Who planned, designed and built the lighthouse, and how did the form and function of the light and other associated structures change over time?

The objective of this report is to address these questions. Part I will give some general historical background which led to the development of modern lighthouses. This discussion will also include information on the early light sources used. Next, we will arrive at the doorstep of the modern lighthouse era, when Augustin Jean Fresnel (Freh-**nel**) first experimented with his new lens system in the Cordouan Lighthouse in France. His ideas on lenses were developed further after his death, and formed the basis of lens technology that was used in both Europe and the United States. A final historical tangent will introduce the U.S. Lighthouse Establishment and trace its development in conjunction with the Southeast Light.

Turning to Block Island, Part II will first briefly acquaint the reader with the island's history. This discussion will lead to the reasons why, in view of its location and the needs of both island and mainland people, the selection of Block Island for a primary lighthouse was a logical choice. Included will be the individuals and groups involved in the site selection and survey

process. The reasons for constructing the Southeast Light as a primary light will be discussed as well, taking into consideration regional connections such as other existing lights and their ranges. The evolution of the lens apparatus, which has gone through various changes between 1873 and 1988, will also be traced. The adjacent outbuildings on the site, likewise, have been changed over the years. For instance, the original frame fog signal house was completed prior to the lighthouse structure, but the remaining fog signal structure (no longer in use) is made of brick. Radio towers have come and gone; and for a brief time, a telegraph station was in operation on the site.

What were the major site changes that occurred between 1873 and 1988? The final section will point these out as a means of tying together the history of the Block Island Southeast Lighthouse, and leading into a discussion of the function and fate of this lighthouse as of 1988.

Part I - In the Beginning...

General History of Lighthouses

As did much of the history of the world, the history of lighthouses began in Egypt. The majority of port cities faced a dilemma: It was important to guide traders into the harbor area, but the cities did not want to supply navigational aids to potential invaders. As certain empires, such as Egypt, grew it became safer to establish beacons, knowing that no one would dare attack a mighty power. While other port cities used fires on hills as beacons, the city of Alexandria opted to build what we today would call the first lighthouse. What little evidence there is suggests that the Egyptians began building the tower for the light in approximately 300 B.C., on the island of Pharos[1] at the entrance to the harbor of Alexandria. It was not completed until twenty years later; archaeologists believe that the completed tower rose to a height of about 450 feet with an open fire at the top as a light source. The lighthouse was in use for the next thousand years. The tower remained standing and unlit for another five hundred years after it ceased being used as a lighthouse, until it was toppled by an earthquake.

Other empires followed suit in building lighthouses. Evidence has been found of the existence of at least thirty lighthouses in use in the Roman Empire before it began to decline in the fifth century A.D.[2] When Europe entered the Middle Ages more lighthouses were erected in Italy, Turkey, France, England, Ireland, and Germany, with the Italians foremost in the venture. Often the ports merely exhibited lights from castle towers situated near the mouth of a channel or harbor, rather than building an elaborate

lighthouse. But lighthouses eventually became the norm when a government considered aids to navigation.

One of the earliest lighthouses of the new age was the French Cordouan lighthouse (which will figure prominently in later discussion on the progress of light technology), originally a very ornate structure which included a hall and chapel. Begun in 1584, it was not completed until twenty-six years later. Unfortunately, the island it was built upon gradually eroded, and in repairing the damage in 1788, Joseph Teulere removed the upper portion and replaced it with a 60 foot stone tower that still stands today.[3]

The British lighthouse historian Alan Stevenson estimates in his nineteenth century writings that the coastal lighthouses grew in number from thirty-four in 1600 to one hundred and seventy-five in 1800. During the eighteenth and nineteenth centuries, Great Britain as well as France placed a high priority on lighthouse construction in conjunction with their development as naval and mercantile powers. One of the most difficult lights to keep in operation during this era was the Eddystone light, first lighted in 1708. It required massive reconstruction by the civil engineer John Smeaton from 1756-1759, at which time he changed the lighthouse to a modified cone design. The lighthouse was made taller by Britain's Trinity House (a corporation in charge of navigational aids) in 1882. The Eddystone light is an example of the growing role played by modern engineering in the construction of lighthouses, particularly those located on unstable islands and rock piles.

Birth of the Modern Lighthouse - Reflectors, Lamps, and Lenses

According to an 1881 treatise by Thomas Stevenson, optical principles were first applied to lighthouses in 1763, when the lighthouses erected at Mersey were fitted with reflectors made of bits of looking glass affixed to the inside of a wooden bowl.[4] It was found by a Capt. Huddart of Trinity House that the curved plane of a parabolic section was the ideal for the reflectors.

Here a slight digression in the discussion will prove useful for explaining the properties of a parabolic reflector and will in turn aid one's understanding of refractive and reflective prisms. First, some definitions. All transparent materials have an <u>index of refraction</u>, which in the case of a lighthouse lens is the ratio of the velocity of light in the first of two media (ie. the air through which the light travels) to its velocity in the second (the glass of the lens). In other words, the ratio between the difference at which light travels through two elements of different densities. This is a standard ratio for properties of materials and, therefore, can be found in tables in textbooks or handbooks

of physics and chemistry. For example, the ratio is 1.00 for a vacuum, 1.0002 for air, 1.333 for water, and 2.417 for a diamond.

Refraction is the change in direction of a light ray as it passes from one medium to another; the change in direction is caused by the ray's change in speed. A good example of refraction occurs when a pencil is placed in a glass of water. The portion of the pencil underwater looks bent from the portion above the water. Because the light rays in the water do not travel as fast as those in the air above it, the rays are refracted, giving rise to the appearance of a bend in the pencil.

The opposite of refraction is reflection (to throw or bend back), which happens at any surface that forms the boundary between two transparent mediums. By various laws of physics (Snell's, for instance) the index of refraction of a material indicates how much light will be reflected at a boundary. There is also a certain angle, called the critical angle, at which a light ray approaching a surface will be totally reflected rather than refracted (even for transparent materials). This is often seen when looking at a window; depending on where one stands on a sunny day, the window may appear transparent or it may act like a mirror and show a reflection. When the reflection is seen in the window, that means that those rays now reaching the eye were within the critical angle when they approached and struck the window glass.

These physical properties and laws are the essence of lighthouse lens technology. The idea of a reflector is to collect light rays which diverge from a point called the focus, and redirect the rays back in a certain direction. In silver-plated material, some of the rays will be absorbed by the plating while a majority of the rays are reflected. The law of reflection, dating from the time of Euclid, states that the angle of incidence (the angle away from a perpendicular to the reflective surface) at which a light ray strikes the surface will in turn equal the angle of reflection (the angle away from the perpendicular which the ray follows as it leaves the reflective surface). Using this property, it was first decided that the best form for a lighthouse reflector would be that of a parabola. The curved plane of a parabolic form reflects light in rays parallel to the axis of the parabola.

In about 1784, Jean Charles Borda caused to be erected in the Cordouan Tower an apparatus of truly parabolic metallic reflectors, where a lamp was placed in front of each reflector at its focus. Also, according to historical records, it was Borda's idea to revolve the lamps and reflectors, thus causing the light to flash. In a fixed light reflector system, each reflector on the frame covered approximately 14 1/2° of divergence, so twenty-five reflectors were needed to light the entire horizon (360°). In a

revolving apparatus such as that suggested by Borda, a chandelier was used that had either a square or, more usually, an octagonal shape. On each flat face, a certain number of separate lamps and reflectors with parallel axes were affixed.

It was realized early in the nineteenth century that the parabolic reflector apparatus might not be the most efficient means for throwing light out to sea. A parabolic metallic reflector will reflect usefully only one-sixth of each lamp's light. The reflectors needed constant polishing due to the smoke of the lamps and this, combined with deterioration caused by exposure to marine atmospheric conditions, caused the reflectors to wear out quickly.

The solution to these problems were finally answered through the experimentation of a Frenchman, Augustin-Jean Fresnel (1788-1827), the man responsible for beginning a new era in lighthouse technology. After beginning his career as a highway engineer, Fresnel later devoted his spare time to the study of optics until, in 1821, he was appointed full-time as the Secretary to the French Commission for Lighthouses.[5] It was at this time that Fresnel began to present his views on optics and their possible application to lighthouse apparatus. He noted that convex glass lenses collected the light emitted from a light source (placed at the lens focus) and, due to the refractive or light-bending capabilities of glass, the light that was transmitted to the other side of the lens poured forth in a beam of light rays parallel to the horizontal axis of the lens. This phenomenon, known since ancient times, was crucial to Fresnel's plans for lighthouse illumination.

Fresnel proposed, essentially, that glass lenses could be substituted for parabolic reflectors in lighthouses. This substitution would greatly decrease maintenance, as glass does not deteriorate as much as metal, and it would increase the light output of the lighthouse lantern, making it easier to be seen at greater distances. To use glass lenses in lighthouses, Fresnel first had to overcome a number of problems. The use of lenses had not been considered feasible prior to Fresnel because a large lens would have been very thick; thus, the piece of glass would have a tendency to absorb more of the light than desirable, and large pieces of glass are difficult to make free of bubbles and striae that cause ray deviations. Also, any lens of the size needed for a lighthouse would be very heavy, making it difficult to install and manipulate. Nevertheless, attempts were made to these large lenses in eighteenth-century lighthouses; according to Thomas Stevenson, "Fresnel states that in 1759 lenses were actually used in some English lighthouses, but were in all probability improperly applied, for their use was afterwards abandoned."[6] The Portland, England, lighthouse is cited by Stevenson as a case where a large lens was installed but later removed.

The problem of constructing large lenses had been approached as early as 1748 by George Louis Leclerc, Comte de Buffon. He proposed that a lens of steps or concentric zones be ground out of a solid piece of glass to prevent absorption of light by the thickness of the material. The concentric zones resulted from collapsing the spherical surface of a comparably large lens. All evidence indicates that Buffon never made one of these lenses. The Marquis de Condorcet reopened the issue with his suggestion in 1773 (in his Eloge de Buffon) that Buffon's idea was correct, but that the lens should be constructed in separate sections, rather than ground down from a single large glass piece. This separate lens ring construction was also described by Sir David Brewster in the 1811 edition of the Edinburgh Encyclpaedia. A lens built from Buffon's design, where a large lens was ground into concentric rings, was first done in approximately 1780 by Abbe Rochon, but difficulties in grinding the glass caused people to lose interest.[7]

These early suggestions for step construction of lenses were directed towards the use of lenses to focus light inward to a point, rather than from a point outward in a beam, as would be the case in a lighthouse. Buffon, for instance, specifically planned to use his lens (if ever constructed) to focus the sun's rays, thereby creating a burning glass; Fresnel quotes Buffon as writing that "this echelon mirror would be one of the most useful instruments in physics."[8] Later suggestions were made to use this type of lens in chemistry as well as in physics.

Fresnel supposedly developed his lens in 1822 independent of these earlier ideas. He was the first to propose an echelon lens, in this case a lens composed of parallel concentric refracting prisms of varying sizes all having the same focus, and then follow through on its development and construction. After hearing of Buffon's theory of lens construction, Fresnel was able to point out why his was a better model (See HAER measured drawings, sheets 7 & 8). Fresnel's proposed lens almost eliminated spherical aberration, which is the divergence of light rays from a parallel beam emitted by a lens that has a spherical surface. Buffon's lens had been the surface of a simple spherical lens "caved-in" in concentric rings, neglecting the fact that each ring after this process would have a different focus. As described by Fresnel:

> We find, by calculation, that the generating arcs of the rings not only ought not to have the same center, but that their different centers should not be situated upon the axis of the lens, and that they depart from it in proportion as the arcs to which they belong are more distant from the center of the lens; so that these arcs on being revolved about the axis do not generate portions

> of concentric spherical surfaces, but surfaces of the kind known to geometricians as annular surfaces.[9]

Consequently, the individual annular lenses are not parts of concentric spheres which share a common center as in Buffon's lens. Fresnel himself states that in "the execution of lenses designed for the illumination of light-houses, it is not necessary to attain a very high degree of accuracy,"[10] but he still thought (and was correct) that the substitution of annular (ring shaped) for spherical lenses would produce a noticeable increase in the light thrown out along the axis of the lens panel. Applying his discoveries of interference, double refraction, and polarization, Fresnel calculated profiles for each lens, which were in fact prisms, in the hope of making the maximum use of the light source. Along with his decision to make annular lenses, Fresnel opted for plano-convex lens construction rather than double convex lenses, as the flat side would make it easier to grind the lens pieces, and comparatively easier to assemble on a table top.

Various men were corresponding and working with Fresnel as he attempted to create a better lighthouse lens. Dominique Francois Arago (1786-1853) contributed as a French physicist and astronomer who had done extensive work in magnetism and optics, including the invention of the polariscope and the polarimeter, and was a strong proponent of the wave theory of light. Jean Baptiste Francois Soleil, a Parisian optician, gave vital assistance to Fresnel by placing his glass grinding apparatus and invaluable skills at Fresnel's disposal.

Unfortunately for Fresenel and company, after all the planning and calculating, the first lens constructed by them in separate pieces had to have spherical surfaces rather than annular because Soleil's apparatus at that time could only construct spherical surfaces. In fact, according to Fresnel:

> That determined me to substitute, for the time being, for each annular surface an assemblage of small portions of spherical surfaces, and even to give to the rings the form of a polygon, instead of a circle, as it was more easy to work pieces of the glass in straight lines.[11]

Thus, the first lens was a polygon of straight prisms with a convex bulls-eye lens in the middle. At the suggestion of Arago, fish glue was used to connect the lens elements because it was clearer and less brittle than ordinary glue. Fresnel gives the measurements as .76 meters (approx. 2'-6") on a side, although preliminary experiments had been done with sides of .55 meters (approx. 1'-9 5/8). Each of the large lenses weighed 75 pounds, including the copper frame; therefore, the eight lens panels in the

first model, with frames, weighed 600 pounds.

It became easier to manufacture a lens in circular rings when the St. Gobain glassworks of Paris sent Soleil arcs of glass cast in the glass work's molds, which he could then grind. These arcs were closer to the finished form than anything he had been able to manufacture with his own apparatus. Fresnel indicates that it was he who suggested to Soleil an apparatus for making annular surfaces on the rings instead of spherical. The glass from St. Gobain, thirty-five miles northeast of Paris, was a slightly green crown glass, whose index of refraction Fresnel calculated to be 1.51.[12] Although it was harder to make this type of glass bubble-free, and it is not as clear in color as flint glass, crown glass proved to be harder, lighter and less subject to atmospheric deterioration than flint glass, which contains some lead.

The Cordouan Lighthouse was chosen for the first installation of the new lens system using annular lenses. The rotating apparatus was comprised of eight large lenses and eight small lenses set in a bronze frame. The small lenses formed a cone above the larger lenses, collecting the upper rays of light and sending them onto large planar mirrors placed to reflect the rays to the horizon. By placing the small lenses slightly ahead of their corresponding main panels, one was able to prolong the duration of the flash. Because both mirrors and lenses were still in use, this system was known as catadioptric, whereas a system using only reflectors is termed catoptric and one using only refracting lenses is dioptric. As shall be discussed, later lenses that employed both refracting and reflecting prisms of glass were also referred to as catadioptric.

Fresnel had thus created a system that was geometrically perfect, but not physically perfect, as he was still using mirrors, which did not reflect efficiently all the light that reached them. Soon variations were made on the original design, first by Augustin Fresnel and then later, after his death, by his brother Leonel Fresnel. A fixed dioptric apparatus was made to add variety to lighthouse characteristics where lenses were being used. For each lens panel of this kind, the center bulls-eye lens was replaced with a refracting horizontal convex band and the annular refracting prisms centered on the bulls-eye were replaced by smaller bands above and below the middle band. The vertical angle subtended by the drum of the fixed light varied from 56° to 57°, as noted by M. Leonce Reynaud in his 1864 Memoir Upon the Illumination and Beaconage of the Coasts of France. These fixed lights could be made to flash by revolving several lenses of vertical elements around the dioptric drum of a fixed lens apparatus.[13] But this only served to increase the amount of material that the light had to pass through, therefore decreasing the intensity of the transmitted

beam.

In the eight-panel revolving arrangement, Fresnel had noted that to avoid the great loss of rays emitted by a light source at the focus, each lens should embrace all rays included in an angle of 45°. However, he later suggested that by decreasing the angle of light embraced by some lenses, quicker flashes could be made amongst the longer ones. For instance, instead of embracing an angle of 45°, the panel would only embrace 22 1/2°. Later versions altered flashing and fixed-type panels.

At one point curved, plated mirrors were put in the upper and lower regions of the Fresnel flashing arrangement; this provided a fixed light between flashes. This idea was dropped because the mirrors required more maintenance than glass. Glass only needed its initial polish done once by machine whereas metal required constant repolishing by which it eventually became worn and scratched. Leonel Fresnel, Soleil, and Alan Stevenson all worked on the idea of using prisms in place of the upper and lower regions, prisms that first refracted and then internally reflected the light. Later experiments by Thomas Stevenson (1871) showed a 31-35% loss of light when using metal, compared to a 23% loss by total reflection in glass.[14] The improved lens and lens-"beehive" apparatus served to make approximately five-sixths of the light useful, a great improvement over the one-sixth transmission of the parabolic reflectors. It was also realized that a revolving panel apparatus would give a greater intensity of light than a fixed apparatus, because the same amount of light was being collected and concentrated through a smaller area.

Augustin Fresnel was obviously very persuasive in convincing people that his lens system was better than the parabolic reflectors. Not only did his apparatus make better use of the available light, it could be applied in different sizes depending on the need of a location; Fresnel originally designated four different orders for use in lighthouses, with the first order being the largest. The orders were first established by the number of concentric cylindrical wicks used in the lamps, a first order lens having four wicks; second, three wicks; and so forth. There were six sizes (or focal lengths) of lens; the two extra sizes resulting from substitution of a small lamp for a large one in the two smallest lens orders.

1st-order focal length =	920 mm (36.22 inches)
2nd-order focal length =	750 mm (27.55 inches)
3rd-order focal length (large lamp)=	500 mm (19.68 inches)
3rd-order focal length (small lamp)=	250 mm (9.84 inches)
4th-order focal length (large lamp)=	182.5 mm (7.38 inches)
4th-order focal length (small lamp)=	150 mm (5.90 inches)

Later, the third- and fourth-order large became the third- and fifth-orders, and the third- and fourth-order small became the fourth- and sixth-orders. A three-and-one-half order apparatus was later made with a focal length of 375 mm (14.76 inches) and in 1885 a hyper-radial lens with a focal length of 1330 mm (52.36 inches) was constructed.

All of these lenses used a single light source, another argument Fresnel used in favor of his system, pointing out that future lamp changes would be easier to make if one was concerned only with a central source rather than the numerous lamps of a parabolic reflector system. With an eye to future developments, Fresnel in 1822 noted: "In fine, all the improvements that time and experience may develop in the production of light can be with the greatest facility applied to lenticular apparatus."[15]

The development of light sources for lighthouses has gone hand-in -hand with the progress in lens technology. Light sources began simply enough, with fires built on hillsides and then candles, which led to the use of "candle power" as the unit of measure for light sources. Oil lamps were eventually used, although they required much care and cleaning. In 1677, Dr. Robert Hook noted ways to improve the burning of an oil flame, after realizing that an oil flame was actually a cone of gas, of which the outside only was on fire. But it was not until 1782 that Aime Argand acted on Hook's suggestions, "by making the wicks and burners of a hollow cylindric form, so as to admit a central current of air through the burner."[16] His lamp was thus constructed of two vertical concentric tubes with a circular wick (usually cotton) between the tubes, and a glass chimney over all. A double air current was created; the improved combustion from oxygen passing along inside and outside the wick made a cleaner light with less smoke and increased a single lamp's candlepower to approximately 7 to 10 candles.

The Argand lamp was improved by the Carcel oil burning mechanism, which provided an abundant supply of oil to the lamp. Further developments were made by Augustin Fresnel and his colleagues by increasing the number of wicks in a single lamp; the number of wicks then corresponded roughly to the different Fresnel lens-orders, with a first-order (largest) lens having the four-wick burner. The number of wicks in the largest lamp had been increased to five by the mid-nineteenth century, with the design in the United States created by George G. Meade in about 1853. Meade was at that time a young lieutenant in the army engineers assigned to lighthouse duty; later, he became a general and commanded Union forces at Gettysburg.

Colza (rapeseed oil), a product obtained from wild cabbages, was the fuel of choice in the lighthouses of Europe. As the United States did not have an indigenous strain of wild cabbage, and the farmers showed no interest in growing it, the U.S. resorted to whale oil for lamp fuel. By the mid-nineteenth century, the number of sperm whales was quickly diminishing, and America turned to lard oil. Finally, in 1878, the lamps of the United States were converted to use kerosene, or mineral oil as it was then more commonly known.

The incandescent oil vapor lamp (IOV), introduced in the late-nineteenth century, functioned much as a Coleman lamp used by campers today. In this lamp, kerosene is forced into a vaporizer chamber where it strikes the hot walls of the chamber and is instantly changed into a vapor. This vapor then goes through a series of small holes to a mantle (heated casing or hood) where it burns like a glowing, bright gas ball.[17] This was the last type of oil lamp used before the advent of electricity in lighthouses. Though electricity was first tested in the early 1900s for use in lighthouses, the IOV lamp was still in use up until the 1920s and 1930s in locations that were difficult to reach with powerlines or where generators had yet to be installed. With the coming of electricity to the lighthouses, the jobs of many lightkeepers were eventually eliminated, as the electric lamps were installed in duplicate and the lamp mechanism could automatically move a new bulb into place if one burned out. Electricity made it possible to turn the light on and off automatically. Also with electricity there were no smoke or fumes produced that could cloud the lens in any way. Thus, the keeper only needed to visit the lighthouse infrequently to replace bulbs and wipe the lens, as compared to the daily care the apparatus had required previously.

Light Characteristics

In the eighteenth century, lighthouse establishments had realized that by arranging the parabolic reflectors with lamps in a polygonal fashion, be it a square, hexagon, octagon, etc., and by placing the arrangement on a revolving table, they could create a light with a distinctive "characteristic" that would make it distinguishable from other lights in the area. Fixed lenses were adequate as long as there were no other lights in the area to cause confusion, including city or town lights as well as other lighthouses. But as more buildings were constructed in port cities, particularly buildings whose height placed their lights well above sea-level, and more lighthouses dotted the coastline in any given area, variations in the lights became a critical necessity. Therefore, a majority of the coastal lights were given distinguishing characteristics. As noted by Augustin Fresnel in 1822,

> .... as fixed lights should illumine simultaneously the entire horizon, the same range cannot be had as in revolving or flashing lights, and as they might also be mistaken for others which, through accident or evil intention, might be shown on the coast, the Commission of Lights [France] thought it better to employ only flashing or revolving lights.[18]

The introduction of the Fresnel "bulls-eye" lens (a plano-convex lens used to concentrate light) had provided a characteristic for those lighthouses requiring distinction. By the end of the nineteenth century all lighthouses had adopted lenses in some form. The production of a beam of light from a light source was an inherent feature of the design; all that was further required was a rotating platform on which to arrange the lens panels. The moving platform was initially supported by small brass wheels, and later by ball bearings, with the first and second order lights often supported on mercury floats after 1890.

Other methods had been used to create flashing lights. By revolving a series of solid panels with periodic gaps around the outside of a fixed light apparatus, it could be made to appear as a flashing or occulting light. ("Flashing" and "occulting" refer to the relative duration of light and darkness, a flash being an interval shorter than the duration of an eclipse, and an occultation being shorter than, or equal to, the duration of the light.)[19] As described previously, it was possible to create a flashing light with fixed intervals by revolving a series of vertical annular lens elements around a fixed drum, but this only served to complicate the apparatus and lessen the intensity of the light.

A source from approximately 1876 mentions that occultation by that time was nearly always produced by revolution of the system of lenses and prisms surrounding the lamp, not by the use of screens rotating around the lens system[20]. By using different combinations and sizes of drum and bulls-eye panels, lights could be given varying characteristics. In the mid-nineteenth century, experiments were begun with the use of colors in creating different lighthouse characteristics, as these would be particularly effective in designating a beacon as a lighthouse and not as building or ship lights.

Sound objections were raised against the use of colored lights. Experimentation showed that the majority of colors were quickly absorbed by fog; the one color that seemed effective was red, as the intensity of red light (although not its brilliancy) is actually greater than white light. White light is composed of

all colors of the spectrum, and when glass of a certain color is placed around a white light, the glass will only transmit the part of the white light that corresponds to its color (e.g., only red rays are allowed to pass through red glass). Therefore, at the time of transmission much of the illuminating power is destroyed. Use of blue and green glass especially was a problem because the majority of artificial light in the nineteenth century had a yellowish tinge, away from the blue-green end of the spectrum, and thus there were even less blue or green rays to transmit if blue or green glass was used.

Blue and green lights also have less penetrative power in fog, which is naturally yellowish in tint, so it may seem unusual that a green light was chosen for a primary seacoast light such as the Block Island Southeast. But, the decision to make the Southeast Light green did not come about until 1929, when other factors made it acceptable and almost necessary to assign to the light a very distinctive characteristic.

The use of green light (which is closer in the spectrum to yellow and red than to blue) was very infrequent until the early twentieth century. As of 1889, according to David Heap, characteristics consisted of flashes, eclipses, and only red and white light:

> But two colors are used, white and red; the latter color is obtained by using a chimney of ruby glass on the lamp or a pane of red glass outside the lens. Red light penetrates fog better than any other color, and it is for this reason that it is used to the exclusion of the rest.[21]

Flashing lights were further distinguished by the interval of time between the flashes: Boston Light in 1889 was a flashing white every 30 seconds; Gay Head Light on Martha's Vineyard flashed white and red, with 10 seconds between flashes, every fourth flash being red.[22] As late as 1926, George Weiss noted that lights were red, white, and alternating red and white, with no mention of green lights. It may very well be the case that the Southeast Light was one of the first and few lighthouses in the United States to be given a green characteristic.

Lighthouses in the United States

Over time, various different forces have been responsible for the construction of lighthouses in the United States. Prior to the establishment of a federal agency, these duties were assumed locally. They were generally initiated by merchants and/or ship captains in order to facilitate trade, financed by the local

government (often through a lottery), and erected and maintained by the people of the area. An example is the Boston Light constructed on Little Brewster Island at the mouth of Boston Harbor in 1714-1716 and believed to have been the first U.S. Lighthouse. As became typical of the day, local merchants had petitioned the General Court of Massachusetts for a lighthouse in this area (allowing night as well as day-time dockings). A lighthouse, they argued, would increase the amount of shipping, while decreasing the amount of shipwrecks, thus boasting the local economy. In order to help finance construction and maintenance, "light dues," a charge based on tonnage, was collected from cargo ships entering the harbor. Twelve such locally sponsored lighthouses were constructed during the Colonial period.[23]

Eventually, it was determined that a regulating agency was necessary to standardize lighthouse practices and insure quality and efficient execution of duties, as well as see to construction and maintenance, etc. Therefore, on August 7, 1789 Congress passed an act assuming to central government the responsibility for aids to navigation. The Treasury Department, under the direction of various officials, oversaw the lighthouse establishment. Although federal regulation was undoubtedly necessary and generally beneficial, there were some drawbacks.

Among the duties assumed by the newly formed lighthouse establishment (later to become the U.S. Light-House Board) was the purchase of lights and all necessary equipment. During the time that the lighthouse service was established, lights were being built with the parabolic reflector system. Due to a lack of support by the Fifth Auditor, the U.S. adoption of the Fresnel system was slow. The Fifth Auditor, Stephen Pleasonton, (influenced by Winslow Lewis,[24] who had a patent on the lamps used with the parabolic reflectors), insisted that the Fresnel lenses were too expensive and that the reflectors were satisfactory. The obvious oversight in the adoption of the Fresnel lens did not, however, go unnoticed. Increasing criticism eventually forced Congress into action.

In March of 1838 a bill was passed by Congress for an appropriation of $15,000 for both a first and second-order Fresnel lens system. These lenses were installed at Navesink Lighthouse in New Jersey (referred to in one 1853 article as the Highlands of Neversink), and their obvious superiority to the reflectors was evident to most. Between 1846 and 1851, while the rest of the world was putting into service over 120 lenses of third or higher order, the U.S. efforts to install Fresnel lenses were put on hold due to lack of funding and disagreement among men in power[25]. Thus, adoption of the Fresnel lens remained slow.

Finally, in 1851 an investigation into the matter was begun by a team of government engineers and Navy personnel. Their findings showed that the majority of the reflectors in use were spherical, not parabolic, meaning that some of the potential light was not being utilized. Therefore, many of the lights could not be seen. It was also found that Tripoli powder was being used on the silver reflectors, despite specific instructions prohibiting its use, as it rapidly deteriorated the polished surface by scratching and wearing.

Due to the investigative committee's report, the Lighthouse Service was taken over by the new Lighthouse Board in 1852, still under the Treasury Department, but now attached to the office of the Secretary of the Treasury. Under the direction of the Secretary, all administrative duties relating to the construction, illumination, inspection and superintendence of lighthouses were discharged. The Secretary also saw to the appointment of an officer of the army or navy assigned to each lighthouse district as lighthouse inspector.[26] The board was composed of engineers and maritime personnel, similar to the investigating team, with the inclusion of an engineering secretary who would be in charge of all fixed aids to navigation, the preparation of plans, specifications and estimates relating to them, and the purchase and repair of the illuminating apparatus. Also under the jurisdiction of the Lighthouse Board was the choice of illuminating device and of fuel. In addition, lightships (which functioned in a manner similar to a lighthouse) were maintained and positioned by the Lighthouse Board as an important part of off-shore navigation. An engineer assigned to each Lighthouse District was under the command of the Lighthouse Board engineering secretary. If Congress made an appropriation for a lighthouse, "the district engineer was charged with the erection of the light, which must be done by contract, if possible, after due advertisement."[27]

Most importantly, the Lighthouse Board voted in favor of replacing the parabolic reflectors with Fresnel lenses, and by 1859 the installation of the lenses in U.S. lighthouses was practically complete. All the lenses used in the United States were manufactured in France by the following government-regulated glass-shapers: Letorneau & Co.; Henry-Lepaute; Sautter, Lemonier & Co.; Barbier & Fenestre; and later, Barbier, Benard & Turenne.

In 1910, the Bureau of Lighthouses under the Department of Commerce replaced the Lighthouse Board. Its duty was to maintain and operate the aids to navigation along the coasts and river channels of the United States and its dependencies. Duties included construction, illumination, repair, inspection, etc. The Bureau of Lighthouses seems to have been the governing body that decided whether to classify lights as primary (for use on coasts

and landfalls) or secondary (for use on the inside of capes and other less important points). A 1926 Bureau report indicates that a feature of the primary lights was an IOV or electric lamp usually over 100,000 candlepower; the Southeast Light, although considered to be a primary light, had an IOV lamp of only 50,000 candlepower in 1929.

The era of the Lighthouse Service ended in 1939, when lighthouse jurisdiction was transferred to the U.S. Coast Guard. The Coast Guard has been the controlling body since that time, with a brief transfer of power to the Navy during World War II. During much of the last 50 years, the Coast Guard has been active in upgrading its aids to navigation through automation and more extensive use of other navigational aids, primarily radio signals. The great lighthouse-building era of the nineteenth and early twentieth centuries seems to have come and gone.

PART II - THE HISTORY OF THE SOUTHEAST LIGHT

Located approximately twelve miles south-southeast of the coast of Rhode Island is Block Island; about seven miles long and three miles across at its widest point. At the southeastern tip of the island sits the Block Island Southeast Light. It is part of a ten acre reservation, enclosed with stone walls to the north, south and east with the dramatic Mohegan Bluffs to the west. This is one of a chain of islands which also includes Long Island, Nantucket, and Martha's Vineyard. Block Island was named for the Dutch explorer and trader, Adrian Block, who landed here in 1614. Settlement of Block Island, however, did not began until the late 1600s.[28]

The Block Island Southeast Light is significant for its role in the history of maritime transportation. Throughout its early days Block Island was known as the "stumbling block" for shipping vessels traveling between the Long Island and Rhode Island Sounds. The island marks the first landfall for ships approaching the New England coast from the south or southeast. Thus, the Southeast Light, and accompanying fog signal, have provided an invaluable aid to the navigation of the hazardous waters around Block Island.

The Southeast Light was the second light established on Block Island (the North light having been built previously). The light was exhibited for the first time on February 1, 1875. At that time it was considered to be one of the finest and best equipped lighthouses on the coast. The light is a first-order rotating Fresnel Lens, manufactured in Paris in 1880. The Fresnel lens was then the most sophisticated in lens technology. The Southeast light is one of only a few lighthouses in the United States which still maintains its original lens, while most were replaced by modern lights requiring less maintenance, during station automation.

Site Selection

The first documented acknowledgement of the need to construct a lighthouse at the southeast tip of Block Island came in 1856. In response to a petition from the Collector of the Customs at Newport, Congress appropriated $9,000 for construction of a second lighthouse on Block Island. A year later the Rhode Island General Assembly ceded the land needed for a lighthouse reservation to the federal government. The U.S. Lighthouse Board, however, decided that the money would be better spent in the moving and reconstruction of the existing light at the north end of the Island.

Thus, the true history of the Block Island Southeast Light

does not begin until the early 1870's with the efforts of one Nicholas Ball, a Block Island merchant and hotel proprietor. He first attempted to acquire funding for a breakwater, a barrier to protect the coastline from the full impact of the waves, on the eastern side of the island. In the spring of 1870, Nicholas Ball traveled to Philadelphia to obtain the endorsement of their Board of Trade in favor of an appropriation for a breakwater in the Block Island Harbor. While there, Ball had an interview with a Mr. Winslow, then president of the Boston and Philadelphia Steamship Company, whose steamship, "Palmetto," had sunk off the southern shores of the Island in 1858. Due to Mr. Winslow's obvious interest in the installation of navigational aids in this area, he had said he would try to influence the Board in favor of the appropriation for the breakwater as well as a first class light on the south end of Block Island. As stated by Mr. Ball,

> since losing their [the steamship company's] steamer Palmetto on the south end of Block Island in May 1858, they were very anxious for a first class light and fog whistle to be placed thereon, and that he [Winslow] knew of no place where one was more needed.[29]

When still unable to obtain funds for the breakwater project in January of 1872, Ball began seeking an appropriation for a lighthouse at or near the southeast part of Block Island. Ball circulated a petition to shipping firms and other interested businesses in Maine, Massachusetts, Rhode Island, Connecticut, New York, New Jersey and Pennsylvania, requesting the interested parties to sign it and forward it to the Congressmen representing their districts. As stated in the petition, the island was "passed by hundreds of vessels daily" and these vessels were "exposed to as much danger as at almost any other place on the entire coast of the United States." Finally, upon the recommendation of the U.S. Lighthouse Board, Congress appropriated the $75,000 necessary for the construction of a first class light and fog signal in the spring of 1872.

John A. Gardner, U.S. District Attorney of Rhode Island, was sent to confer with Block Island landowners about the chosen site. Despite some initial difficulties, land for the site was purchased from George G. Sheffield, Jr., for $1350.[30] The ten-acre plot of land was surrounded on three sides by a stone wall, with the Mohegan Bluffs acting as the fourth boundary.

Although necessity dictated a light at this site, geologically, it proved not to be an ideal choice for a lighthouse or any other structure. The height of the bluff at the southeast point (approximately 150 feet) makes it a desirable location in that distance above sea level combined with the height of the tower

puts the lantern at 212 feet. However, the geological make-up and the rate of erosion of the bluff, it would seem, were not adequately studied. A soil section taken in 1917 by Michael Haltenberger in the Southeast Light area shows the majority of the soil to be diluvium, composed primarily of various kinds of clay, pebbles, and sand.[31] In reaction to this, large boulders of granite have been deposited on the island's beaches in an attempt to prevent the cliff from eroding away.

Factors favoring the lighthouse site, in addition to height, were the availability of a constant water supply for the steam fog-signal boilers and the need to supplement the other lights that were then functioning in the area. Ships approaching New England and the mouth of Long Island Sound from the south and southeast were in need of a means of avoiding Block Island. The only other primary lights in operation in the Third Lighthouse District during the mid-nineteenth century that were helpful towards this end were the Fire Island Light and the Montauk Point Light. These could guide a mariner along the southern shore of Long Island, but another reference light was needed after these, as well as a fog-signal for bad weather.

The Lighthouse Structure - 1873-1988

As was the practice of the Lighthouse Board at this time, the plans for the structure were designed under the direction of the district's Chief Engineer.[32] In the Third District, in which Block Island was located, this was Col. I.C. Woodruff. The actual construction work was advertised and opened for bidding. The contract for the construction of the lighthouse and dwelling was awarded to T.H. Tynan of Staten Island. The contract for the cast-iron superstructure was awarded to Paulding, Kemble & Company for $9,400. The contract for the lantern was awarded to Bailey & Debevoise for $3,448.[33] Final approval of all plans and contractors came from the Lighthouse Board itself, with communications being conducted with the district engineers by the Engineer Secretary of the Board, who at this time was Major E.H. Elliot.

It is unclear from the records on exactly what date the lighthouse construction began.[34] Despite the date stone on the building face which reads 1873, there is evidence that construction did not begin until 1874. Perhaps it signifies the year that the plans were approved by the Lighthouse Board, which we know to be 1873. From a letter dated March 13, 1874, one can deduce that actual construction did not begin until that year; the letter, from Engineer Secretary Maj. Elliot to Third District Engineer Col. Woodruff, reads:

The bids for the erection of a tower and keeper's

> dwelling at [the] mouth of east Point of Block Island, Rhode Island, having been referred to the Board on the 4th instant, it was voted in consideration of the facts presented in your several communications that the contract be awarded to Messrs. M.S. and J.H. Tynan [of Staten Island] for the sum of Thirty-two thousand three hundred and eighty dollars ($32,380.00), the building to be of iron with granite trimmings and you are authorized to enter into contract accordingly.[35]

As the contract was not awarded until March of 1874, we can assume that the construction did not begin until after that time. sA indicated in the 1874 Annual Report of the Lighthouse Board, numerous problems had arisen, putting some strain on the original appropriation funds of $75,000:

> The expenses attending the purchase of the land at this site, district attorney's fees, and the connections with the water-supply, were somewhat greater than was anticipated. This, and the exorbitant cost of hauling the machinery of fog-signal, lumber, labor, &c., have drawn heavily on the appropriation for this station. The metal-work and lantern have to be delivered to the contractors for the dwelling and tower at the site, and the appropriation being all covered by the contracts, no funds remain available for the completion of the reservoir [a reinforcement of the pond on the site]. The sum of $4,500 is asked to meet expenses attending the same.[36]

This additional funding was approved on June 23, 1874, and work resumed.

The Lighthouse Board had issued specifications a for first-order lighthouse brick tower in 1861 and the specifications for a double dwelling in 1862.[37] The design for the Southeast Light seems to have followed these specifications, with some variations. The tower, for instance, specified as being 150 feet, was reduced to approximately 63 feet. This variation was no doubt a result of the height provided by the site itself. In regard to interior workmanship, both sets of specifications provide thorough guidelines for thickness of walls, window sizes, etc.

Designs for lighthouses were generally executed by an engineer under the direction of the Lighthouse District Engineer and thus, were to a degree, standardized. Often engineers transferring from one district to another took their styles of lighthouse design with them; plans for lighthouses were also passed around from one district to another. That is why a lighthouse in Florida may look

almost exactly like a lighthouse on the Great Lakes. Some designs were used again and again with only slight variations. This transfer of design seems to have occurred to some extent in the case of the Southeast Light. The 1873 floor plans and elevations of the Southeast Light appear to match those of 1870 for the Cleveland Light in Cleveland, Ohio. They were, however, the only two constructed in this design. The Cleveland Light was discontinued in 1892 and the structure was demolished sometime in the early twentieth century, making the Block Island Southeast Light the only one of its kind.

Although truer to the Gothic form, the light station appears to be a hybrid of the Gothic Revival and Italianate styles, both popular during the period in which the structure was built. The Gothic is seen in its sharply sloping, cross gabled roof, with the slight parapet on the front facing ell, in the unornamented eaves, and the paired windows that extend into the gables. On the other hand, there is an absence of the pointed window arches and verge boards that typically identify the Gothic Style. Italianate features are seen in the paired windows with segmentally arched window heads, and in the entry porch supported by squared beveled posts. However, it lacks the flat roof with the distinctive large brackets in the eaves; the surest mark of an Italianate residence.

The Southeast Light Station consists of a five story brick light tower, connected by a 1-1/2 story hyphen to a 2-1/2 story Gothic Revival, duplex residence with twin 1-1/2 story kitchen wings to the rear. The tower and residence are brick with an ashlar granite foundation and trim. The superstructure of the tower is of cast-iron.

The light tower is composed of an octagonal, pyramidal shaft, a circular cast-iron parapet surrounded by an open octagonal gallery and a 16-sided lantern surrounded by an open circular gallery and capped with a 16-sided pyramidal roof. The tower shaft consists of two brick shells connected by cross walls. The outer shell forms the hollow frustrum of the octagonal pyramid while the inner is that of a cone. The open well is lit by six narrow double hung sash windows topped with segmental arches. The brick shaft terminates at the fourth story in the capital-like superstructure of the parapet and lantern. On the exterior, a cast-iron cornice with a brick frieze provides the molding for eight iron brackets with ornamental spandrels and pendants which support the gallery. At the top of the parapet drum is the 11.5' lantern with 10' windows consisting of three fixed panes on each of the sixteen sides. In the center of the lantern or lens room is the fixed 1000 watt electric lamp which is surrounded by the revolving lenticular apparatus of eight Fresnel lenses, each measuring 39-1/2" by 30-9/16" set in a brass frame.[38]

The residence, joined to the light tower by a perpendicular 1-1/2 story connecting wing at the center of its southeast facade, has a 2-1/2 story main block with two 1-1/2 story rear kitchen wings. The main entrance is located in the northeasterly side of the connector (a second on the southwesterly side has been replaced by a window). To each side of the connector on the main block is single story porch. The porch posts on the southwesterly side retain their decorative beveled, bracketed posts while the balustrade, and the entire porch on the other side, has been replaced with plain squared posts and balustrade. The fenestration of the facade consists of two 3/4 length 9-over-9 pane windows on the first story, with a 4-over-6 pane, centrally located wall dormer with segmental arched window head. There are identical dormers over the entry doors. The gabled ends of the main block consist of two pairs of 6-over-6 pane windows on the first and second floor, and one pair of 4-over-four panes on the half story. The kitchen wings to the northwest rear are connected to the main block by a single story, shingled frame passageway. Each wing is lit by one pair of 4-over-6 pane windows and a single 2-over-2 pane window in its outer wall and a single 6-over-6 pane window in its inner wall. The kitchen garrets are lit by flanking 2-over-2 pane windows to either side of the chimney block in the gable end.

The Annual Report of 1875 tells us that the Block Island Southeast Light station was completed and the light was first exhibited from the tower on February 1, 1875. In the years since its completion, the structure has seen very little change. Most of the alterations that were made were a matter of general maintenance or modernization. The significant changes that have taken place are in the light apparatus itself, not in the building.

One of the earliest major repairs to the Southeast Light station came in 1886 when the original shingle roofing was replaced with slate. Several appropriations were made in the early 1900s for general repairs, including re-shingling of the roof with asbestos (1923), new higher chimney tops (1933), and the installation of indoor bathrooms (1938). This last endeavor resulted in one of the few changes in the original floor plan. Two bathrooms were put in place of the second floor keepers' workroom in the connector, and a third bathroom was partitioned off on the first floor, eliminating the entryway on the west side of the building. Also in 1938, major repairs to the chimneys and roofs, plus interior repairs necessitated by water damage, were required after the hurricane of September 21 of that year.[39] Many of the repairs or internal alterations since the 1930s have been associated with storm damage or updating the structure internally with modern plumbing and electrical conveniences. None of these improvements, however, altered the outward appearance of the

building.

As seen from the east in 1988, the exterior appearance of the lighthouse had changed with the addition of steel fire escapes to the outside of the living quarters, and replacement of the original, more ornate front porch balustrade with one more plain. From the west, the exterior had been altered by fire escapes as well, and the original door leading from the porch into the interior had been replaced with a window.

The Lens and Lamp System - 1873-1988

Some of the most significant changes at the Southeast Light have been made to the apparatus that makes the light a primary aid to navigation - the lens and lamp assembly. The Southeast Light was intended for use as a primary seacoast aid to navigation, and thus was equipped with the largest Fresnel lens, the first-order. It was the decision of the Lighthouse Board to assign the light a fixed white characteristic, and the lens apparatus was then purchased from the glass shaping firm of Barbier & Fenestre of Paris for the sum of $10,000. At the Southeast Light, it was unnecessary to illuminate the landward side of the lantern; therefore, instead of the traditional eight panel first-order lens assembly (in which each panel is responsible for 45° of coverage), the Southeast light required only six lens panels, covering 270°.

A copy of the original packing slip filed at the Third District office on December 20, 1873, indicates that the lens arrived in the United States prior to the building of the lighthouse. The slip is marked specifically for Block Island, and also mentions that it is a 270° lens, rather than one that illuminates 360°. Instead of leaving the two landward panel spaces empty, the Southeast Light used a method of collecting the posterior light rays, as described by Leonce Reynaud:

> When an apparatus is not required to illumine the entire horizon, it is important to direct to the sea the rays which would diverge uselessly toward the land side. For that purpose recourse is had to spherical reflectors, which cover the dead [landward] angle of the apparatus and return to the focal point the rays which come in contact with them.[40]

In the case of the Southeast lens apparatus, the drawing shows that the two reflecting panels were composed of prisms set at such angles to the lamp as to utilize the properties of total internal reflection in a prism. By using glass as opposed to a metallic reflecting surface, more light was made available for the beacon,

as metallic surfaces had a tendency to absorb more light than glass and reflect more light at useless angles. The position of each prism was calculated so that the reflected rays would not cross each other at the exact focus (the lamp), but slightly higher. Thus the reflected light would not be absorbed by the body of the lamp, and the burner would not overheat, which could cause the wicks to char or possibly fuse.[41]

The first lamp at the Southeast Light was a four-wick Fink's Hydraulic Float of 12,188 candle power, a type of lamp which could be used where only a part of the horizon required illumination.[42] On a four-wick lamp, the diameter of the outer circular wick was 3.5", the inner wicks being 3.0", 2.5", and 7/8". The lamp first used lard oil, later adopting kerosene when that fuel became popular in the 1880s. The oil was stored initially in drums on platforms in the base of the tower.[43] The four-wick lamp remained in use until 1889, when it was replaced by a five-wick lamp (candle power unknown).

Various authors of the 1880s described the Southeast lens in their commentaries of Block Island, giving us further information on the appearance of the lens assembly. Reverend Samuel T. Livermore's History of Block Island (1877) tells how six people were able to stand inside the lens arrangement at one time.[44] In Block Island Illustrated, with Descriptive Sketch (1884), Edward E. Pettee notes that the lens uses a "cylindrical hoop of glass as a refracting lens, above and below which are separate glass prisms of triangular section, placed at proper angles to reflect and refract the light," with the result that "all the light is made to finally pass out in rays parallel to those of the central lens;" "the whole is arranged in the form of a hollow cylinder, narrowing at the top and bottom, twelve feet in height and six feet in diameter."[45] Pettee's account reinforces the point that the first lens assembly installed in the Southeast Light was a fixed light.

According to Pettee in 1884 the four-wick lamp was burning lard oil at the rate of 900 to 1000 gallons annually, all of which were stored in tanks in the oil room in the base of the tower. During the winter, he reported that the lamp consumed 2 1/2 gallons of oil nightly. The five wick lamp installed in 1889 burned a 1/2 gallon of oil hourly, according to the Providence Journal of July 21, 1889, which did not indicate whether this was an average rate for an entire year. The next change made in either lens or lamp (other than alterations in choice of fuel) came on February 12, 1907, when the five-wick lamp was replaced by an incandescent oil vapor [IOV] lamp of 45,690 candle power.

In 1888, the Lighthouse Board Annual Report listed Gay Head

Light (Martha's Vineyard, Mass.), Sankaty Head Light (Nantucket, Mass.) and Montauk Light (Long Island, N.Y.) as the other primary lights in the vicinity of Block Island. As described in The Lighthouses of the World and Coast Fog Signals (1896 ed.), Montauk and Sankaty were fixed white with a single flash (Montauk once every two minutes and Sankaty a ten second flash every minute). The white, primarily steady appearance of these lights made them very similar to the fixed white of the Southeast Light, whereas Gay Head was a flashing red and white light, thus easier to distinguish. A fourth light, the fixed first-order light of Great West, or Shinnecock Bay, Long Island, was exactly the same as the Southeast Light in 1896.

It may have been confusion with other area lights that led in 1929 to a major change in the lens assembly of the Southeast Light. Plan #7276 on file at the Office of the Superintendent of Lighthouses, Third District, Staten Island, N.Y., 1928, gives the layout of the intended lens and lens pedestal change. The plan indicates that the new assembly would be a revolving apparatus with bulls-eye Fresnel lenses, creating a flashing as opposed to a fixed light. This assembly was intended to have only four flash panels, interspersed with four blind panels; the duration of the flashes and eclipses was dependent on the speed at which the lenses would revolve around the light source.

When this new system was put into operation in 1929, various other changes were made in conjunction with the new flashing characteristic. First, the characteristic color of the lens was changed from white to green, making the Southeast Light the only first-order green light in New England.[46] The green beacon was achieved by placing a shade of colored glass around the light source. Second, the light source was also updated at this time to a Type A, 55 millimeter IOV lamp (kerosene burning) of 50,000 candle power.

The addition of a mercury float for the rotating lens assembly was a third change made at the Southeast Light in 1929. In the words of J.A. Purves:

> The development of the modern system of lighthouse apparatus and illumination may be said to have originated in the mercury-float mechanism, devised in 1890 by the late Monsieur Bourdelles, Director-General of the Central Lighthouse Service of France.[47]

The mercury float provided a means of rotating a heavy apparatus on something other than ball bearings and "chariot" wheels, both of which succumbed rapidly to wearing by friction caused by the large size and weight of the apparatus. As described by Purves:

> In place of the roller or ball bearings employed in the past for revolving apparatus, an annular trough is employed, in which there floats a second annular trough, on which is carried the dioptric apparatus. In order to steady the revolving superstructure, and to render it capable of a certain amount of adjustment, a vertical spindle projects downward from the apparatus through the mercury trough to some distance below it, and is supported and guided upon suitable bearings.[48]

Due to the density of mercury, only a thin film (approximately 1/16 to 1/8 inch) is required between the two troughs in order to provide a surface on which the assembly will glide or float.[49]

After the major change from fixed white light to flashing green in 1929, a change that came after 54 years of the light existing in its original form, the next alteration was made in a relatively short span of time. A proposal to increase the candle power of the light was made in an April 29, 1931, "Recommendation as to Aids to Navigation; "[50] by changing the 55 millimeter IOV lamp to a 1000 watt P.S. 52 clear, 115 volt C7a filament lamp, the candlepower would be increased from 50,000 to 169,000 candle power. As reported by District Superintendent J.T. Yates, the change in lamp would also change the duration of the flash from .030 seconds to .168 seconds.[51] Whether or not the lamp-change was carried out at this time is unclear.

The next clue we have to an alteration made in the lens assembly comes from a "Recommendation" made on March 7, 1933, which reads as follows:

> The present flash of light is too quick to be readily picked up and it is proposed to lengthen the flash by installing four additional dioptic [sic] sections of a 1st order lens, on hand, and cut the revolutions of lens from 4 to 2 per minute thereby doubling length of flash. The candlepower is not changed. The length of flash (taken at 50% of peak C.P. and 2 R.P.M. of lens) is 0.3 sec. and 3.45 sec. eclipse. The apparent discrepancy with the present flash of 0.2 sec. was due to fractions, the .2 flash being slightly more than actual.[52]

It is interesting to note that four more dioptric panels were already on hand at the site, which brings up a point worth mentioning at this time. As the lens was found in 1988, three of the lens panels were manufactured by Henry-Lepaute of Paris, but the other five are stamped with the trademark of L. Sautter & Co., Paris. All of the panels have numbers in the lower corners of the

frames that indicate which lenses were to be paired when assembling the apparatus; inspection of these number pairings on the Southeast lens in 1988 revealed that few match. One of the lenses manufactured by Henry-Lepaute is stamped with the date 1880. We know from the historical evidence collected that the Southeast Light was fixed white in 1880, so the dated flash panel must have been used elsewhere before its 1929 (or 1933) installation in the Southeast Light. The most probable hypothesis is that some, or all, of the flash panels were "cannibalized" from other discontinued first-order lights, which would account for the different manufacturers' stamps and inconsistent matching of the frame numbers. No records were discovered which indicated previous locations of the lens panels.

Correspondence from Junior Lighthouse Engineer, Ellis Gordon and Keeper, Carl F.W. Anderson, to the District Superintendent in 1933 indicate that the change in characteristic was a vast improvement. Gordon comments that the increase in the length of the flash also seems to have increased the intensity of the light. Both men remark on the many favorable comments that they have received from the "boatmen" on the ease with which the Southeast Light can now be seen.[53]

No other changes were made in the lens apparatus after this time, although several recommendations were made concerning maintenance of the lens and mercury float. In 1939, the Lighthouse Service was absorbed by the U.S. Coast Guard; the boundaries of the lighthouse districts were changed, and the Southeast Light became part of the 1st Coast Guard District.

One significant request for work authorization in 1947 almost marked the end of the Southeast Light's Fresnel lens. On January 9 of that year, the commander of the 1st Coast Guard District requested that a Crouse-Hinds double drum 36" rotating green beacon of 190,000 candle power be sent to the lighthouse site to replace the first-order Fresnel light then in use. The request notes that the Southeast Light was then using a 1000 watt, 120 volt T-20 2-C-5 filament clear mogul base lamp, operating at 170,000 candle power, and the lens was driven by a hand wound, side drive, type C lens clock. The fate of the Southeast Light if this action were carried out? As described in the form:

> [The] 1st order lens and pedestal will be dismantled, crated and shipped to C.[oast] G.[uard] Base, Constitution Wharf, Boston, for storage or as Headquarters may direct. I request Headquarters instructions as to whether this lens and pedestal be surveyed for crating and storing, crating and sale, or be destroyed at the site.[54]

The reason for installing the Crouse-Hinds was to provide a beacon for both sea and air navigation, whereas the Southeast Light, by design, was most useful only for sea navigation. In 1950, a letter concerning the proposed change was addressed from the 1st District Commander to the Commandant. In his letter, the commander presents an alternate plan for the Crouse-Hinds beacon, stating that the district files do not contain any correspondence which would indicate that a navigational aid suitable for both sea and air navigation is specifically needed in the immediate vicinity of Block Island. He proposes to place the unit at Gay Head Light instead, for the following reasons:

> a) The first order mercury mounted lens at Block Island Southeast is <u>in excellent condition and should operate indefinitely without any major repairs</u> (M. Thomas, HAER emphasis). This aid is entirely satisfactory for surface navigation.
>
> b) The ball bearing mount for the Gay Head lens is a constant source of maintenance trouble caused by excessive wear of the ball races....
>
> c) Gay Head Light is not now electrified.... It would then appear that here is the opportunity to eliminate a serious District maintenance problem [Gay Head Light] and, at the same time, provide an improved aid to both sea and air navigation.[55]

This alternate plan was accepted; a communication of March 23, 1950, instructs the Officer in Charge at the Block Island Southeast Light Station to ship the Crouse-Hinds Lighthouse Beacon equipment from Block Island, where it had been stored in anticipation of installment, back to Boston. And so the Southeast Fresnel lens was saved to shine another day.

After this threat passed, mention of the Southeast Light appeared in Coast Guard correspondence primarily for minor maintenance actions, more often involving the dwelling structure and the outer buildings than the lens and lamp. A Coast Guard recommendation was made in 1954 to strain and clean the mercury, and give the light a "complete overhaul," the meaning of which is not made clear. Sometime after 1947 the light source was changed to a 1000 watt, 120 volt, Q 1000 T-20-BP Mogul Bipost lamp emitting 237,000 candle power.[56] This equipment was still in use in 1988. In case of a bulb burn-out there is a trigger arm with fresh bulb that will be moved into place automatically.

By 1988, the bull's-eye Fresnel lenses had been in service at

the Southeast Light for 59 years without serious mishap. In that period there were several major hurricanes that damaged the outer structure, including the lantern room roof, but the lenses survived intact, suffering only minor cracks that may also be attributed to shifting and flowing of the glass with time.

The Fog-Signal

The first fog-signals in the United States were a far cry from the sophisticated electronic warning signals of today, but nevertheless their use undoubtedly saved many ships from certain destruction. As noted by George Weiss, the first U.S. fog-signal installed at Boston Light in 1719 was a cannon fired when necessary to answer the signals of ships in thick or foggy weather, rather than being fired at regular intervals to warn ships. This initial use relieved the keepers of a responsibility that later keepers would have to bear when it became normal practice to sound the signal periodically (for instance, every half-hour) during foggy weather.

Use of cannons ceased as later signals took the form of bells, trumpets and, eventually, steam whistles (1857) as the usage of steam technology progressed. A type of steam siren, first employed at the Sandy Hook East Beacon in 1868, was initially used at the Block Island Southeast site. The fog-signal structure was the first building completed at the lighthouse location. As noted previously, the need of a water supply for the fog-signal had been a primary consideration when selecting the site. Water for the signal was drawn from a pond approximately 400 feet northeast of the signal house. Essentially, a fog-signal can be just as important as a light because it can be used in both clear and foggy weather, whereas a light is useless in foggy weather. However, at times it can be difficult to determine the direction from which the fog signal is coming. Also, due to site location, the range of some fog signals may have blocked areas referred to as "dead zones" where sound waves cannot travel. The site of the Southeast light evidently lent itself to the use of a fog signal since it was the first structure erected at the Southeast Light station. A consideration was probably also the lesser effort of establishing a fog-signal in comparison to constructing a lighthouse, as well as the high incidence of fog here.

In 1875, the Southeast fog-signal was put to use in experiments on the abnormal phenomena of sound in connection with fog-signals, conducted by Prof. Joseph Henry, chairman of the Light House Board and director of the Smithsonian Institution. In his experiments, steamships sailed closer to and farther from the island at various headings, under a variety of weather conditions. The results indicated, essentially, that varying air currents

affect the duration and direction of the sound projected by fog-signals. Because of these demonstrated aberrations in the transmission of sound, mariners are often warned to not rely heavily on the warning of fog-signals, but to regard them only as auxiliary aids.

The fog-signal equipment, housed in a frame structure, was described in the Providence Evening Bulletin of 13 September 1873 in the following manner:

> The building is 15 x 30 feet, with twelve feet posts. The whistle is a reed instrument of Brown's patent, and makes two blasts per minute. A cistern has been dug near the building, twelve feet in diameter and twelve feet deep, for a back reservoir in case of a dry time. A well is also to be sunk for a similar purpose. The water ordinarily is to be obtained from a pond near there [still in existence as of 1988].

Nicholas Ball's records show that he was not particularly pleased with the location of the fog-signal house or with the site selection in general. He believed that the fog siren whistle did not throw its sound westward far enough for vessels to hear in time to prevent their running aground on the western shores of the island. In Ball's opinion: "It would have been much more satisfactory if the light and whistle had been erected on a bluff just opposite Black Rock [Southwestern Block Island; see Sheet 2 of HAER Measured drawings]."[57]

The 1873 fog-signal apparatus consisted of a four-horsepower boiler and seventeen-foot cast-iron trumpet, with a brass siren placed at the small end of the trumpet. A duplicate set of equipment was installed in the building in case of the failure of the first. Thus, the second set included its own boiler so that it would be entirely independent of the first. The seaward end of the trumpet was approximately five feet in diameter. Within the siren at the small end of the trumpet,

> the sound is produced by the rapid revolutions past each other of two flat discs pierced with a great number of small holes. A jet of steam under high pressure is projected against the discs, which revolve past each other more than a thousand times a minute. As the rows of small holes in the two discs come opposite each other, the steam vehemently rushes through, and makes the singular and piercing noise which the siren gives forth.[58]

Improvements in fog-signal technology soon made this design obsolete. By 1906, the steam siren had been replaced by a first-

class compressed air signal powered by kerosene engines.

On the morning of April 28, 1908, the Third District Engineer reported that the frame fog-signal house at the Southeast Light had burned to the ground, according to Head Keeper, Simon Dodge. Although an unfortunate occurrence, this opened the way for new technology at the site. The old engines were replaced with new 13 h.p. Hornsby-Akroyd oil (i.e. kerosene) engines and the innovative Bowser system of oil handling machinery was installed. The Bowser system stored the oil in two tanks, one for the lamps and the other for the fog-signal, in a convenient cellar or oil-house at a safe distance from the tower, from where pipes led to two measuring pumps, one in the watchroom of the tower and the other in the engine room of the fog-signal house. The system eliminated carrying of oil, and the oil drawn off was measured by gauges on the pumps. Evaporation, leakage and odors were also prevented by the Bowser system.[59]

The fog-signal with its new engines was housed in a slightly different arrangement when the fog-signal house was rebuilt in 1908. Specifically, the sirens of the system were re-located to the roof of a separate small building 100 feet southwest from the new brick building, which was now the engine house. In 1913 the sirens were moved from the separate structure and mounted on the engine house because the partially exposed air pipes between the engine house and the siren house experienced problems in cold weather that inhibited the performance of the signal.[60]

In 1915, a general improvement in fog-signals (not necessarily at the Southeast site) was made when the revolving plate in the siren was replaced by a cylinder with peripheral slots (rotor), which was enclosed in a casing also with slots, leading to a horn or trumpet. The rotor could be driven mechanically or automatically by air or steam pressure. The compressor-type signal, driven by internal combustion engines, was easier to start than the whistles, and had a greater distinctiveness of note. As of 30 June 1925, there were 543 United States fog signal stations, primarily on the Atlantic Coast.

The Block Island Southeast fog-signal equipment changed again in 1934, when the siren was replaced by a Typhon diaphragm horn. The Typhon horn had a vibrating metal diaphragm operated by a system of valves and differential air pressure; the vibration was transmitted to resonators that emitted the sound. This type of signal remained in use at the Southeast Light until 1974, when it was replaced by an electronic fog-signal installed directly on the lighthouse tower, still in use as of 1988 (see HAER measured drawings, sheet 12).

The compact electronic fog-signal (far different from the seventeen foot trumpets on the 1873 signal) uses a vibrating diaphragm to produce sound. A metal plate between the pole pieces of a magnet vibrates as an alternating current passes through metal windings around the magnet. Due to its vertical arrangement, the signal concentrates the propagation of the sound wave in a horizontal direction rather than in a vertical direction, which would waste the sound vertically above the surface of the water.

In accordance with an Operations Bill issued by the Coast Guard in 1962, the specifications for turning the fog-signal on are that it "shall be operated when visibility due to fog or other atmospheric conditions is less than 4.1 miles, that is, when Block Island Southeast Lighted Whistle buoy becomes obscured due to conditions stated."[61] The fog-signal produces a five-second blast, followed by a 25 second silence. As soon realized by the author of this report in the summer of 1988, these conditions exist a great deal of the time and the fog-signal is therefore often in operation.

Other Structures

The technology of aids to navigation went beyond beacons and fog-signals with the introduction of radio signals in the early twentieth century. Subsequently, structures were built at the Southeast Light to accommodate these changes. Also, it must be remembered that the Light functioned as a residence for several families. Various out-buildings were constructed to meet the needs of daily life, including barns during the carriage days and, later, garages for the new horseless carriages.

One of the first new structures recorded at the site appeared in 1898, when the U.S. was at war with Spain. From April 23, 1898, until July 31 of that year, a detachment of naval personnel was stationed at the Southeast Light, where they constructed a 90-foot mast with a 40-foot cross yard from which signal flags were hung. A small dwelling structure (12 x 20 feet) was built 100 feet northwest of the signal mast, which is presumed to have been on the highest point of ground on the property, somewhat north of the lighthouse.[62] In 1899, after the signal station had been abandoned, requests were made to remove the station to the shore end of Block Island's Great Salt Pond.

In 1899, a telephone was installed at the Southeast Light, although it could first be used only from the Southeast Light to the North Light and the Life-Saving Stations. The telephone was followed shortly by the telegraph in 1903. The telegraph equipment

and building, as well as a complete newspaper printing office, were situated near the Southeast Light and were used in the publication of the Block Island Wireless, published by the Providence Journal Company. According to the Providence Journal:

> The day's news will be telephoned from the office of the Providence Journal Company to the Journal company's wireless station at Point Judith [Rhode Island] and from there it will be hurled through the air and "picked up" by the island station.[63]

The Block Island office was later used as a residence.

Radio signals were first installed at lighthouses in 1921. By using these signals, navigators could locate the position of their ship by taking cross bearings on two or more radio stations, or by repeated bearings on the same location with the distance logged between the bearings. The advantages of radio signals over lights is obvious; radio waves transmit farther than light rays can be seen, and radio can be used in bad weather. The apparatus usually consisted of a commercial, panel-type spark transmitting set of approximately one kilowatt of power, with a timing signal for producing the desired signal at regular intervals. The signals themselves were kept simple to avoid confusion.

It is assumed that the installation of radio equipment at the Southeast Light took place in 1931, as a Providence Journal article of December 1936 marked the fifth anniversary of the radio beacon. In the government publication "Notice to Mariners" of February 13, 1948, the following information is given to navigators:

> Effective at 1200 on 12 February, 1948, the radio beacon at Block Island Southeast Light Station was changed to provide for continuous carrier operation during the entire radiobeacon minute with keyed modulation. The beacon operates 1 minute on, 2 minutes off, continuously 24 hours daily. There is no change in operating freguency or characteristic.[64]

An "Aids to Navigation Operation Bill" (U.S. Coast Guard) of April 17, 1962, says that the radio beacon range was then 100 miles and the signal characteristic was two dots, a dash, followed by another dot (. . - .). This morse code signal can be used by mariners and aircraft alike. In 1988, the radio was operating on a carrier frequency of 301 kilohertz, range 20 miles, and transmitting the morse code signal for Block Island (B I: - ... . .) for 50 seconds followed by a ten second steady tone. Several tower structures have been constructed, ending with the tower used in 1988 that, as seen from the HAER drawings accompanying this report (site

development maps, HAER measured drawings sheet 3), was several feet northwest of the abandoned brick fog-signal house.

A radar station was erected on the property in 1943 for use in World War II; it was placed on a high point of land north of the lighthouse structure.[65] A request to demolish the remaining structures was submitted by the keepers to the District Commander in 1962. All that remained of the station in 1988 were the foundations.

The majority of the barns and garages that have been on the site were frame buildings, as seen in old photographs. The business of keeping animals on the property probably ended with the absorption of the Bureau of Lighthouses in 1939; the keepers after this time were no longer civilians who had lived on the island most of their lives, as previously. One record that we do have of construction on out-buildings dates from January of 1939:

> The old barn which was used as a garage and the old storehouse were destroyed by the storm of Sept. 21, 1938. It is proposed to replace these buildings with a combination garage and store house building, the building to be of brick and in accordance w/ Drawing no. 8367.[66]

Permission was granted on February 28, 1939, for Frasca Construction Company to build a 3-car garage and storehouse at Block Island.

The ranch house that appears on the site maps of 1988 was built in 1962 to house a Coast Guard lightkeeper and family. A request was also made by the keepers in 1962 to remove a fence in front of the ranch house that had been placed there by the International Nickel Company; the fence had been used at one time to test metals and paints for exposure to salt air, wind, etc. Permission was granted to demolish the fence.[67]

Conclusion

The Block Island Southeast Light has captured the imagination more than almost any other light on the New England seacoast. Since 1877 when the Light was mentioned in Livermore's History of Block Island and described in a Block Island tourist guidebook by "Ben Mush" of the Norwich Morning Bulletin, the Southeast Light has been a Block Island tourism landmark.[68] The lighthouse's picturesque Gothic Revival architectural styling and its dramatic location, 150 feet atop the Mohegan Bluffs, make it a continually intriguing site.

Of interest from the standpoint of the history of technology,

the original light apparatus can still be used as an aid to navigation; the optical principles on which the lens assembly was based have not changed with time. Some changes, however, have been made. The major site and technological changes at the Southeast Light have of course followed the progress in lighthouse technology. These can be broken into specific periods to economize the changes, beginning with 1873-1900. In this time period, the station was built and put into operation, and the lamp went from four to five wicks. From 1900 to 1925, most of the alterations involved the fog-signal, which changed from steam to compressed air. The fog-signal structure changed from frame to brick (1908), had two separate structures from 1908-1913, and then one structure after that. The lamp for the light was changed to an incandescent oil vapor lamp in 1907.

Between 1925 and 1950, both the lens assembly and the fog-signal were changed, although neither resulted in major structural changes to their respective buildings. In this time period, the lens system was changed from fixed white to flashing green (1929-1933), which included the replacement of the fixed drum lens with an assembly of first 4 then 8 revolving flash panels. A new electric light source was also added in this time. The fog-signal, still housed in the brick structure, was changed to a Typhon diaphragm horn in 1934. The installation of radio signalling equipment by 1931 changed the appearance of the site with the addition of several metal skeleton towers.

From 1950 to 1988, the lens remained unchanged. The fog-signal house was abandoned in 1974 when a compact electronic fog-signal was placed on the outer platform of the tower lantern. The major changes in the appearance of the site came from the building of the ranch house in 1962, and the continuing erosion of the bluff.

What will be the fate of the Southeast Light in the coming years? Because of the eroding Mohegan Bluffs on which the lighthouse rests, the building faces an uncertain future. As depicted on HAER measured drawings, sheet 2, much of the original cliff edge has fallen away, including a 10-12 x 50-100 foot section since 1982. A geological report compiled by LeMessurier Associates, Inc., of Cambridge, Mass., in 1985 cites four erosion forces at work: direct rainfall runoff, indirect rainfall runoff (from the land above the bluff), seepage erosion (erosion caused by springs breaking out in the face of the slope as a result of water seeping horizontally along sand and gravel layers to the point where they are exposed at the face of the bluff), and wave erosion of the lower bluff. The final conclusion of the report was that the erosion could be retarded by slope grading, application of drainage nets, etc., at a cost of $2,275,000.[69]

A second alternative to insure a solid future for the Southeast Light is a suggestion to move the lighthouse back from the edge of the bluff. Efforts were being made in 1988 by the newly established Block Island Southeast Light Foundation, Inc. to raise funds for such a move. Feasibility studies have shown that the project would cost approximately $2,500,000. On October 13, 1988 a bill was put forth to the U.S. Senate to authorize the Secretary of the Department of Transportation, under which the U.S. Coast Guard operates, to convey the light to the Block Island Southeast Light Foundation. This would enable the Foundation to establish and maintain a nonprofit center at the lighthouse for two purposes. The first would be to raise funds to move and restore the threatened lighthouse. The second purpose would be to interpret and preserve the material culture of the U.S. Coast Guard and the maritime history of Block Island.

For now, however, the fate of this lighthouse is uncertain. As of 1988, there were only nine manned lighthouses (periodically checked by a Coast Guard Lightkeeper, although not necessarily on a daily basis), all other lights having been replaced by automated beacons, with the Fresnel lenses of the discontinued lighthouses either put in storage or sent to museums, or broken to salvage their metal frames. The Lighthouse is presently serving a dual purpose as an aid to navigation for the hundreds of mariners who daily pass safely by the "Stumbling Block" with the help of the Southeast Light and fog-signal, and as a museum exhibiting various artifacts from Block Island history, with a focus on the history of the Southeast Light. Through the efforts of the Southeast Light Foundation (and similar institutions elsewhere) people will be reminded of the historical significance of lighthouses, and of Augustin Fresnel's wedding of science and technology. The Southeast Light exemplifies the fruits of that marriage.

PROJECT INFORMATION:

The Block Island Southeast Lighthouse recording project was initiated and funded by the United States Coast Guard in compliance with the 1985 Amendments to the Historic Preservation Act of 1966. Sally K. Tompkins, Deputy Chief, HABS/HAER, coordinated the project and Richard K. Anderson, Jr., HAER Staff Architect, served as project leader. The recording team consisted of historian, Mary M. Thomas (University of Notre Dame), architectural field supervisor, Mabel A. Baiges (Kansas State University), and architectural technicians, Patricio del Real (Washington University) and Lee Ann Jackson (Auburn University). Martin Stupich was contracted by HAER to take large format photographs. The history was edited by Richard K. Anderson and Catherine C. Lavoie before being prepared for transmital to the Library of Congress. The photographic captions were written by Richard

Anderson, and the drawings edited by Richard Anderson and Isabel Yang of the HAER office in Washington.

ACKNOWLEDGMENTS:

HAER wishes to acknowledge the assistance of the numerous individuals and organizations in the production of the historical report and measured drawings for the Block Island Southeast Lighthouse recording project. Dr. Robert Scheina, historian, and Lt. Commander Robert Garrett, Aids to Navigation of the Washington Headquarters of the U.S. Coast Guard were instrumental in the funding of the project and in the selection of the Southeast Light for documentation. The project was intended to be the first in a series of such projects for the documentation of significant lighthouses operated by the Coast Guard, and as a pilot project, it was also intended to be one of many events marking the 200th anniversary of the Coast Guard's service in the United States. Mr. Douglas Sundstrom, archivist at the Coast Guard's Shore Maintenance Detachment at Governor's Island (New York), was of invaluable help in securing copies of original drawings of the Southeast Light's site plans and lenses as well as various other historical records. Drawings of the building were also provided to the HAER team by Dr. Gerald Abbott, a director of the Block Island Historical Society and the Block Island Southeast Light Foundation, Inc. Boatswain Mate 1st Class (BM-1) Steven Koskinen, lightkeeper at the Southeast Light at the time of the project, was also of aid in locating documents related to the facility's more recent operations.

Considerable historical research on the Southeast Light was performed in advance of the project at the National Archives, the Library of Congress and the Smithsonian Institution in Washington, D.C. by Catherine C. Lavoie, HAER staff Historian. The voluminous research of Pamela Littlefield and Robert M. Downie, both of the Block Island Historical Society, was invaluable to HAER, since the materials they had collected or written about Block Island and the Southeast Light saved many weeks of research. Technical information on the history, design, and construction of Fresnel lenses was collected by Richard K. Anderson, Jr., HAER staff architect, and further research was conducted by Mary M. Thomas, project historian, who also wrote the history of the Southeast Light during the project. The Block Island Historical Society provided housing to the recording team and gave generous access to their society's records for the purposes of the project.

During 1988, considerable consultation occurred between the Block Island Historical Society, the U.S, Coast Guard, and the office of U.S. Senator John Chafee regarding the disposition of the

Southeast Light building and its operating Fresnel lens. While activity to transfer title of the building from the Coast Guard to the Block Island Southeast Light Foundation, Inc. had gone on for years, the Coast Guard's ongoing program to automate the lighting equipment at its lighthouses threatened the removal of the ca. 1880 Fresnel lens from the building in 1988. During the summer of 1988, a compromise was reached--the new light equipment is to be erected on a separate steel tower, and the old lens left inoperative in the lighthouse for exhibit. At the end of 1988, a bill had been submitted to the U.S. Senate by the Honorable John H. Chafee of Rhode Island to transfer title of the Southeast Light to the Block Island Southeast Light Foundation, Inc. in order that the foundation may open the building as a museum. The foundation's immediate plans are to raise funds for moving the building several hundred feet back from the eroding edges of Mohegan Bluffs to avoid its eventual destruction. It appears at this writing that Congress may even underwrite the moving expenses for the lighthouse.

APPENDIX

RECENT PRINTED ITEMS THAT FEATURE IMAGES OF BLOCK ISLAND'S SOUTHEAST LIGHTHOUSE.

BOOKS:

BLOCK ISLAND SUMMER, 1972, p. 98, 100, and cover. (photo)

MARINE PHOTOGRAPHY OF PETER BARLOW, 1972; p. 31. (photo)

BROCHURES:

CHAMBER OF COMMERCE, Block Island, map directory, 1970's; photo.

CHAMBER OF COMMERCE, Block Island; map directory, 1980's; drawing.

NATIONAL HOTEL, Block Island, 1983-5; photo.

NATIONAL HOTEL, Block Island, 1986-7: photo.

RHODE ISLAND DEPT. OF ECON. DEV., "WELCOME TO R.I.", photo, cover.

RHODE ISLAND TOURIST GUIDE, 1973; photo, cover.

MAGAZINES:

ADVENTURE ROAD, Summer 1983; photo, p.3 & 20, 21.

BETTER HOMES AND GARDENS, March 1987; R.I. ad & photo, p. M-7.

BOATING, July 1980; p.51, photo.

FORD TIMES, June 1968; painting, p. 12.

KEEPER'S LOG, Vol. 2, No. 1, 1985; p. 20 (drawing), p. 30 (photo).

MOTOR BOATING 7 SAILING, June 1971, p. 50, 51, photo.

NATIONAL GEOGRAPHIC, Sept. 1968; p. 382, 383, photo.

NEW YORK, April 28, 1986; photo, cover.

ON THE SOUND, June 1971; photo, p. 39.

ON THE SOUND, June 1973; photo, p. 52.

YACHTING, March 1984; photo, p. 89.

YANKEE MAGAZINE GUIDE TO NEW ENGLAND, Summer 1980; photo, p. 180.

MISCELLANEOUS:

HARBOR LIGHT, B.I. First Baptist Church; newsletter masthead.

NATIONAL TRUST FOR HISTORIC PRESERVATION, 1985 program, rear page.

NEW ENGLAND TELEPHONE, White Pages, 1972, photo cover.

RHODE ISLAND STATE ROAD MAP, 1985/86; photo.

WASHINGTON TRUST COMPANY, bank newsletter, Summer 1984; cover.
[Welcomed the bank to its first office on Block Island.]

SAILING CALENDAR, Peter Barlow, 1988, cover and June photo.

NEWSPAPERS:

PROVIDENCE JOURNAL;
Jan. 16, 1973; photo, p. 1.
Apr. 18, 1976; photo, p. B-1
July 6, 1979; photo, p. W-1.
Sept. 5, 1983; photo, p.1.
Mar. 19, 1985; photo, p. X-3.

PROVIDENCE JOURNAL - SUNDAY MAGAZINE SECTION;

Nov. 8, 1959; photo, p. 28.
July 11, 1965; photo, p. 15.
June 18, 1967; photo, p. 6.
Mar. 10, 1968; photo, p. 17.
June 17, 1984; photo, cover.
Mar. 9, 1986; photo, cover.

SUMMERTIMES, Pawtuxet Valley Times, June 28, 1984; photo, p. 10.

YACHTING'S RACE WEEK NEWS, Welcome to Race Week; photo, p. 6.

Collected by Robert M. Downie,
Block Island, R.I.

BIBLIOGRAPHY

"Announcement: Block Island Wireless." Providence Journal, July 9, 1903.

Ball, Nicholas. Block Island, R.I. Volume 3: Lighthouses, Life-Saving Stations, Cable. Typescript. Providence: Rhode Island Historical Society, 1890.

"Clippings File." Record Group 26, Box 4. National Archives, Washington, D.C.

Executive Department, State of Rhode Island. "Rhode Island in the War with Spain." General Assembly, January session, 1900. Providence: E.L. Freeman & Sons, Printers to the State, 1900: 346-348.

Haltenberger, Michael. Physical Geography of Block Island, R.I.: Part I. Budapest, Hungary: Hungarian Adriatic Association, 1917.

Holland, Francis Ross, Jr. America's Lighthouses: Their Illustrated History Since 1716. Brattleboro, Vermont: The Stephen Greene Press, 1972.

Fresnel, Augustin. "Memoir Upon a New System of Light-House Illumination." In Leonce Reynaud, Memoir Upon the Illumination and Beaconage of the Coasts of France. Washington, D.C.: Government Printing Office, 1876.

Greenwood, Richard. NPS Form 10-900, National Register of Historic Places Inventory. Nomination form, "Block Island Southeast Light."

Heap, David P. Ancient and Modern Lighthouses. Boston: Ticknor & Company, 1889.

"The Fresnel Lens, or Dia-Catoptric Illuminating Apparatus for Light Houses." In The World of Science, Art, and Industry: Illustrated from Examples in the New York Exhibition, 1853-54, eds. Benjamin Silliman, Jr., and C.R. Goodrich. New York: G.P. Putnam & Company, 1854: 145-150.

LeMessurier Associates, Inc. "Report on Southeast Light, Block Island, Rhode Island." File No. 5787, October 1985. Cambridge, Mass.

Livermore, Samuel T., Rev. A History of Block Island From Its Discovery in 1514 to the Present Time. Hartford, Conn.: The Case Lockwood & Brainard Company, 1882 edition.

Mush, Ben. Block Island: A Hand-book with Map. Norwich, Conn.: James Hall, 1877.

Pettee, Edward E. Block Island Illustrated, with Descriptive Sketch. Boston: Deland & Barta, 1884.

Purves, J.A. "Modern Lighthouse Apparatus." Nature **61** (February 22, 1900): 393.

"The Optics of a Lighthouse." Science for All.

Reynaud, Leonce. Memoir Upon the Illumination and Beaconage of the Coasts of France. Washington, D.C.: Government Printing Office, 1876.

Stevenson, Alan. Account of the Skerryvore Lighthouse with Notes on the Illumination of Lighthouses. Edinburgh: Adam and Charles Black, 1848.

Stevenson, Thomas. Lighthouse Construction and Illumination. London & New York: E. & F.N. Spon, 1881.

_____. Lighthouse Illumination, 2d ed. Edinburgh: Adam and Charles Black, 1871.

United States Bureau of Lighthouses. "Recommendation as to Aids to Navigation." July 9, 1913. Record Group 26, Box 840, file #1104A-1104E. National Archives, Washington, D.C.

United States Coast Guard. "Bill of Operations," Block Island Southeast Light Station. April 17, 1962. Boston Regional Branch, National Archives & Records Administration.

United States Coast Guard. "Request for Work Authorization." Project No. ecv-47-64. January 9, 1947. Boston Regional Branch, National Archives & Records Administration.

United States Coast Guard. File: ecv-626,220. February 10, 1950. Boston Regional Branch, National Archives & Records Administration.

United States Coast Guard. "Recommendation as to Aids to Navigation." January 5, 1939. Record Group 26, Box 840, file #1104B. National Archives, Washington, D.C.

United States Coast Guard. "Notice to Mariners." No. 18, February 13, 1948. Boston Regional Branch, National Archives & Records Administration.

United States Lighthouse Board. Correspondence. Record Group 26, Box 180, file #1102. National Archives, Washington, D.C.

United States Lighthouse Board. "Descriptive Lists of Light-Houses." Southeast Light site, 1873. Record Group 26, USCG Descriptive List Box. National Archives, Washington, D.C.

United States Lighthouse Board. "Letters to the Third Engineer." Record of Letters, No. 7 (Jan. 3, 1874-June 30, 1879). Record Group 26. National Archives, Washington, D.C.

United States Lighthouse Board. "Management of Lens Apparatus and Lamps." No date given. National Archives, Washington, D.C.

Weiss, George. The Lighthouse Service: Its History, Activities and Organization. Baltimore, Maryland: The Johns Hopkins Press, 1926.

Wheeler, Wayne. "America's First Lighthouse: Boston Light." Keeper's Log (Fall 1984): 2-5.

Notes

1. Pharos means lighthouse, so presumably the name was assigned to the island after the lighthouse had been built.

2. Francis Ross Holland, Jr., America's Lighthouses: Their Illustrated History Since 1716 (Brattleboro, Vermont: The Stephen Greene Press, 1972), 2.

3. The title of the world's oldest existing lighthouse goes to the lighthouse in Corunna, Spain. First mention of it occurs in the 4th century A.D., but it was most likely built earlier by the Romans. The square stone structure is approximately 130 feet tall. The tower went out of service at one time, but was later restored and encased in a light tower of granite by the Spanish government. It is still functioning as a lighthouse at the present time. Holland, 2.

4. Stevenson learned this from Practical Seamanship, an account published in 1777 by a Mr. Hutchinson, the dockmaster of Liverpool. Thomas Stevenson, Lighthouse Construction and Illumination (London & New York: E. & F.N. Spon, 1881), 54.

5. In Fresnel's own words, as read to the French Academy of Sciences in 1822: "There has existed for several years a Commission of Lights, the members of which were chosen from among the most distinguished scientists and the Inspectors of the Royal Corps of Engineers des Ponts et Chaussees. Charged with devising a general project for the distribution of light-houses upon the coasts of France, they sought at first to determine whether the system of illumination already in use could not be improved. Several interesting experiments had already been made upon the brilliancy of the light produced by small wicks placed in large Lenoir reflectors; but other duties, with which a majority of them were charged, prevented them from devoting the necessary time to these investigations. In 1819 M. Arago offered to take charge of these experiments, provided M. Mathieu and myself were allowed to assist him. This proposition, adopted by the Commission, was submitted to M. Becquey, Director General des Ponts et Chaussees, who also approved it, and desired me to devote the greatest care to these investigations. A wish [to be] worthy of his confidence, and of that of the Commission of Lights, as well as the importance of the subject, induced me to devote all my attention to these investigations." Augustin Fresnel, "Memoir upon a New System of Light-House Illumination," (1822) as it appeared in Leonce Reynaud,

Memoir Upon the Illumination and Beaconage of the Coasts of France (Washington, D.C.: Government Printing Office, 1876), 161.

6. T. Stevenson, (1881), 53.

7. Alan Stevenson, Account of the Skerryvore Lighthouse with Notes on the Illumination of Lighthouses (Edinburgh: Adam and Charles Black, 1848), 240.

8. Fresnel, 163.

9. Ibid.

10. Ibid., 165.

11. Ibid., 164.

12. A. Stevenson, 242.

13. Leonce Reynaud, Memoir Upon the Illumination and Beaconage of the Coasts of France (Washington, D.C.: Government Printing Office, 1876), 65.

14. Thomas Stevenson, Lighthouse Illumination, 2d ed. (Edinburgh: Adam and Charles Black, 1871), 10.

15. Fresnel, 169.

16. T. Stevenson, (1881), 55.

17. Holland, 23.

18. Fresnel, 171. "Evil intention" was also used in the United States, and some say it occurred on Block Island, although the majority of the histories indicate that the islanders were more concerned with saving lives and ships, rather than causing vessels to wreck on the rocks by falsely displaying harbor lights, etc.

19. George Weiss, The Lighthouse Service: Its History, Activities and Organization (Baltimore, Maryland: The Johns Hopkins Press, 1926), 35.

20. "Science for All" article, 358.

21. David P. Heap, Ancient and Modern Lighthouses (Boston: Ticknor & Company, 1889), 171.

22. Ibid., 172-173.

23. The information given in this section is provided so that, when speaking of the Southeast Light history, the reader will have a historical context within which to relate certain facts. More extensive information on the development of lighthouses and the Lighthouse Service can be found in Francis Ross Holland, Jr.'s America's Lighthouses: Their Illustrated History Since 1716 (Brattleboro, Vermont: The Stephen Greene Press, 1972).

24.It was Winslow Lewis, a ship captain, who in 1810 after years of testing convinced the Federal Government to adopt the Argand lamp and parabolic reflector system as a means of illuminating lighthouses. This was superior to the old spider lamp system previously used. However, its adoption was one of the factors which prevented the adoption of the infinitely better Fresnel lens. Holland, America's Lighthouses, p. 14-15.

25. Benjamin Silliman, Jr., and C.R. Goodrich, eds., The World of Science, Art, and Industry: Illustrated from Examples in the New York Exhibition, 1853-54, "The Fresnel Lens, or Dia-Catoptric Illuminating Apparatus for Light Houses" (New York: G.P. Putnam & Company, 1854), p. 145.

26. Heap, 205-206.

27. Ibid., 208. As described by George Weiss in 1926, the Lighthouse Service was still contracting out projects, although the plans and specifications were still prepared by the Service; "This is necessary because of the unusual engineering and architectural peculiarities involved in lighthouse construction." Weiss, p. 30.

28. Rev. S.T. Livermore, History of Block Island, Rhode Island, originally printed 1877 (Forge Village, Mass.: The Murray Printing Company, 1961 ed.), 9-19.

29. Nicholas Ball, Block Island, R.I.: Volume 3 - Lighthouses. Life Saving Stations. Cable. Typescript (Providence: Rhode Island Historical Society,1890), 3.

30. The warranty deed was recorded on July 14, 1873, in the land records of the Town of New Shoreham, Block Island, Rhode Island, in Deed Book No. 15, pp. 17-18.

31. Michael Haltenberger, Ph.D., Physical Geography of Block Island, R.I.: Part I. (Budapest, Hungary: Hungarian Adriatic Association, 1917), 10-11.

32. United States Coast Guard, United States Lighthouse Board. "Descriptive List of Light-Houses," Southeast Light site, 1873, Record Group 26, USCG Descriptive List Box, National Archives, Washington, D.C.

33. The information of the last two contracts was obtained from the "Clippings File" of Record Group 26, Box 4, National Archives, Washington, D.C. This file contains all references to specific lighthouses as "clipped" from the Annual Report of the Lighthouse Board; the Southeast Light clippings were from 1872 to 1907. Also, when "lantern" is used in this report, it refers to the enclosed structure at the top of the lighthouse tower that contains the lens and lamp apparatus.

34. That is, from the records that could be found; many records of the Lighthouse Board and the later Bureau of Lighthouses were damaged by fire (at the National Archives in 1921) or misplaced and presumed lost in the absorption of the Lighthouse Service by the Coast Guard in 1939. Much of the pertinent information in this report has come from subject indexes, miscellaneous letters between the engineers, and correspondence of the Lighthouse Board, all found in Record Group 26 at the National Archives in Washington D.C.

35. "Letters to the Third Engineer," U.S. Lighthouse Board, Record of Letters, No. 7 (Jan. 3, 1874-June 30, 1879), Record Group 26, National Archives, Washington, D.C., p. 39. There is some discrepancy as to whether it was T.H. Tynan or J.H. Tynan.

36. Ibid.

37. "Specifications for a First Order Light-House (Brick Tower)," prepared at the office of the Light-House Board, October 1861 (Washington, D.C.: Government Printing Office, 1861) and "Specifications for a Double Dwelling for the Keepers of First Order Lights," prepared at the office of the Light-House Board (Washington, D.C.: Government Printing Office, 1862).

38. NPS Form 10-900, National Register of Historic Places Inventory - Nomination Form, "Block Island Southeast Light," form prepared by Richard Greenwood, Historical Consultant, 215 Indiana Avenue, Providence, RI, 02905, (401) 461-7193; for the Block Island Historical Society.

39. This information was obtained from various "Recommendations as to Aids to Navigation" and other correspondence of the Lighthouse Service (including estimates of cost, purchase orders, standard contracts), which can be found in the "Correspondence of the Bureau of Lighthouses, 1911-1939," Record Group 26, Box 840, files #1101-

1105A (Washington, D.C.: National Archives). I refer the reader to these writings for further information on other repairs such as plastering, pointing of stonework, repainting, etc., all too numerous and common to be mentioned here.

40. Reynaud, Memoir Upon the Illumination and Beaconage of the Coasts of France, p. 54. This had been suggested earlier by Alan Stevenson, who used a spherical mirror behind a Fresnel lens to collect and return the rays.

41. An isometric drawing of the original lens, compiled from photographs, the packing slip, and historical documentation, accompanies this report in the HAER measured drawings of the Southeast Light (1988).

42. "Management of Lens Apparatus and Lamps," U.S. Lighthouse Board, no date given, p. 11. According to this description, a hydraulic lamp is composed of a reservoir of the proper capacity to hold the oil needed for use in one night; a supply cistern, whose top is flush with the bottom of the reservoir; and a burner, whose crown is flush with the bottom of the cistern. A tube leads from the bottom of the reservoir into the cistern; at the end of this tube is a movable stop, which is in turn attached to a hollow metallic ball by means of a curved piece of metal. The ball regulates the flow of oil in the cistern by opening and closing the tube. The oil is then conducted from the cistern to the separate wicks by several tubes. There is an overflow cistern to catch any run-off. (pp. 10-11).

43. Fresnel in 1822 had an interesting suggestion for a "lamp alarm", in case the keeper was asleep when the lamp malfunctioned. He suggested placing a cup to catch some of the oil overflow, with the cup being balanced on a lever arm by a counterweight. The cup would be pierced by small hole that would empty it only if the overflow of oil stopped (which would indicate a malfunction). "But when the oil stops flowing, and before the light is extinguished, the cup empties, the counterpoise drops, and the motion of the lever disengages the spring of an alarm-bell. The noise of the bell continues for some time, and is sufficient to awaken the keeper." Augustin Fresnel, "Memoir Upon a New System of Light-House Illumination," (1822) as it appeared in Leonce Reynaud, Memoir Upon the Illumination and Beaconage of the Coasts of France (Washington, D.C.: Government Printing Office), 170.

44. Rev. Samuel T. Livermore, A History of Block Island From its Discovery in 1514 to the Present Time (Hartford, Conn.: The Case, Lockwood & Brainard Company, 1882 edition), 10.

45. Edward E. Pettee, Block Island Illustrated, with Descriptive Sketch, (Boston: Deland & Barta, 1884), 63-65.

46. The exact reasons for changing the light from fixed to flashing and from white to green are unknown, although it is possible to hypothesize as to the reasons. The other New England coastal lights that were similar in appearance, particularly Great West Light (and Point Judith, although a smaller fixed white), may have confused mariners. The choice of a green color may have been almost necessary, as many of the flashing lights in the immediate vicinity were already red and/or white. The choice of green for a primary light is somewhat unusual because, as mentioned in Part I, green is not as visible as red or white in bad weather situations.

47. J.A. Purves, "Modern Lighthouse Apparatus," Nature **61** (February 22, 1900): 393.

48. Ibid., 393.

49. No records or technical information were found which completely described the principles of the mercury float or which gave the gravity of mercury used in the device. It does not appear to actually float the entire weight of the rotatory lens assembly by sheer displacement. (A schematic diagram sent to us by the Coast Guard's Shore Maintenance Detachment appears to show some of the lens assembly's weight bearing on a ball thrust bearing in the lens spindle). Although numerous calculations were conducted by Richard K. Anderson, Jr., HAER Staff Architect, and myself, we were unable to determine the exact amount of mercury and the exact weight of the lens assembly from exterior measurements and the sparse written information on the interior measurements. Estimated weight of the mercury ranged from 600 to 2200 pounds; the weight range of the lenses was similarly as broad.

50. United States Bureau of Lighthouses, "Recommendation as to Aids to Navigation," April 29, 1931, Record Group 26, Box 840, file # 1104E, National Archives, Washington, D.C.

51. In a letter written by Mary Anna Clark, wife of head keeper Willet H. Clark in 1929, she reports the flash as being .3 seconds in duration and occurring every 3.7 seconds. The grammatical tense of the letter indicates that it was done either in 1929 or soon after, but by official account the light did not acquire this flash characteristic (which was still the characteristic in 1988) until 1933. Letter courtesy of Jean Napier (grand-daughter of Mary Clark), Block Island Historical Society.

52.United States Bureau of Lighthouses, "Recommendation as to Aids to Navigation," March 7, 1933, Record Group 26, Box 840, file #1104C, National Archives, Washington, D.C. Several handwritten notes on this form refer to a request made in May of 1931 that suggested the same idea, but had been ignored at that time. One note also comments that the 0.3 second flash is too short for an important light. There seems to have been some minor bickering going on.

53. Correspondence, Dept. of Commerce, Lighthouse Service, April 27-28, 1933, Record Group 26, Box 840, file #1104C, National Archives, Washington, D.C.

54. Commander, 1st Coast Guard District Project No. ecv-47-64, 9 January 1947, "Request for Work Authorization," Boston Regional Branch, National Archives & Records Administration.

55. Coast Guard Correspondence, 10 February, 1950, File: ecv-626, 220, Boston Regional Branch, National Archives & Records Administration.

56. This is a General Electric lamp bulb that is obtained by the Block Island Officer in Charge from North American Philips Lighting, distributed through Major Electric & Supply Inc., Pawtucket, RI.

57. Nicholas Ball, 14.

58. Pettee, 66.

59. "Correspondence of the Lighthouse Board," Record Group 26, Box 180, 1901-1910, file #1102, National Archives, Washington, D.C.

60. United States Bureau of Lighthouses, "Recommendation as to Aids to Navigation," July 9, 1913, Record Group 26, Box 840, file #1104A, National Archives, Washington, D.C.

61. United States Coast Guard, "Bill of Operations," Block Island Southeast Light Station, April 17, 1962, Boston Regional Branch, National Archives & Records Administration.

62. "Rhode Island in the War with Spain," compiled by the Executive Department of the State of Rhode Island and presented to the General Assembly, January session, 1900 (Providence: E.L. Freeman & Sons, Printers to the State, 1900): 346-348.

63. "Announcement: Block Island Wireless," Providence Journal, July 9, 1903 as contributed from the files of Robert Downie, Block Island, RI. Further information on the Block Island Wireless can

be found in Garrett D. Byrnes' and Charles H. Spilman's The Providence Journal: 150 years, (Providence, RI: The Providence Journal Company, 1980), 244-250.

64. United States Coast Guard, "Notice to Mariners, No. 18, 13 February 1948, Boston Regional Branch, National Archives & Records Administration.

65. Many Americans do not realize how close the enemies came to the New England coast during WW II. One of the most famous incidents occurred one day before the official end of the war, when the German submarine U-853 sank an American vessel in New England coastal waters. United States naval ships promptly sank the submarine 5 miles off the coast of Block Island as it tried to escape into deeper water.

66. United States Coast Guard, "Recommendation as to Aids to Navigation," Jan. 5, 1939, Record Group 26, Box 840, file #1104B, National Archives, Washington, D.C.

67. Much of the Lighthouse Service, and then the Coast Guard, correspondence is highly amusing but somewhat irrelevant to the report, so I have neglected to mention it in the text. It seems that the keepers had to ask permission for almost everything. One example is a request asking to move a yard playpen from one spot to another. Another amusing correspondence from 1909 involves the question, by a keeper, asking "whether a dog kept on a government reservation for light-house purposes, the property of the light-keeper, can be taxed by the local authorities," to which the Inspector of the Third Light-House District answered in June of 1909: "[Your letter] might be read to mean that the dog was kept for lighthouse purposes. The Board has no knowledge of authority ever having been granted for the employment of a dog, nor can the dog be considered light-house property as the Light-House Establishment in common with other governmental institutions is prevented by law from accepting presents." Record Group 26, Box 180, file #1102, National Archives, Washington, D.C.

68. The book by "Ben Mush" (probably an alias, as it appears on the title page in quotes) is entitled Block Island: A Hand-book with Map, for the guidance of summer visitors, telling how to reach that pleasant little place of resort, and what to do on getting there: together with description and sentiment calculated to adorn an otherwise plain tale, and to excite the interest of the apathetic, yet without too widely departing from the strict truth (Norwich, Conn.: James Hall, 1877), 30-33.

69. "Report on Southeast Light, Block Island, Rhode Island," File No. 5787, October 1985, as compiled by LeMessurier Associates, Inc., Cambridge, Mass.

-END-

ADDENDUM TO:
BLOCK ISLAND SOUTHEAST LIGHT
(Block Island Southeast Lighthouse)
Spring Street & Mohegan Trail at Mohegan Bluffs
New Shoreham
Washington County
Rhode Island

HAER RI-27
HAER RI,5-NESH,1-

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

HISTORIC AMERICAN ENGINEERING RECORD
National Park Service
Interior Region 1, North Atlantic - Appalachian
U.S. Department of the Interior
1234 Market Street, 20th Floor
Philadelphia, PA 19107

HISTORIC AMERICAN ENGINEERING RECORD

BLOCK ISLAND SOUTHEAST LIGHT

HAER No. RI-27

This report is an addendum to a 54-page Narrative Format report previously transmitted to the Library of Congress in 1988.[1] The 1988 report provided an exterior description of the lighthouse as of 1988 and history of the lighthouse up until that year. This report presents a history of the lighthouse and physical changes between 1988 and 2014; a description of the lighthouse's surrounding cultural landscape and maritime setting; and a description of the building interior. Where information has remained the same since the previous report, the relevant sections have been omitted from the present Outline Format report.

Location: Spring Street and Mohegan Trail at Mohegan Bluffs and Southeast Point on Block Island, New Shoreham, Washington County, Rhode Island.

The Block Island Southeast Light (Southeast Light) is located at latitude: 41.1536940, longitude: 71.5523385. The coordinate was obtained on June 19, 2015 by plotting the center point of the building in Terrain Navigator Pro software on the Block Island, RI 1:24,000 1998 Quadrangle. Accuracy of the location is to +/- 12 meters. There is no restriction on the release of this location to the public.[2]

Present Owner: Southeast Lighthouse Foundation

Present Use: Aid to navigation (light maintained by U.S. Coast Guard); Block Island Southeast Light Foundation headquarters and future museum

Significance: The Southeast Light, which is a designated National Historic Landmark and is listed in the National Register of Historic Places, is nationally significant in the areas of maritime history, transportation, and architecture. Constructed in 1875 by the U.S. Lighthouse Board (now subsumed within the U.S. Coast Guard), the lighthouse has provided a primary and invaluable aid to navigation in the hazardous waters of the Atlantic Ocean and Rhode Island Sound off Rhode Island and has attached to it a number of superlatives that make it an important example of a U.S. Lighthouse Board navigational aid. The lighthouse marks the first island landfall for ships approaching the New England coast from the south and east, has the highest elevation of any lighthouse in New England, and contains one of only 12 functioning first-order Fresnel lenses in the country.

[1] Mary M. Thomas, "Block Island Southeast Light," HAER No. RI-27 (National Park Service, U.S. Department of the Interior, 1988).

[2] As described in the Physical History section below, Block Island Southeast Light has been relocated within its original land parcel as recorded in the original HAER documentation of 1988. The latitude and longitude coordinates reflect the building's new location; however, its street address remains the same.

Southeast Light exhibits a unique Victorian Gothic architectural design that exemplifies a relatively brief era of architectural sophistication at the Light House Board and provides one of the U.S.'s most powerful expressions of the romanticism inherent in the function and setting of a lighthouse.

Historian: John J. Daly, Public Archaeology Laboratory, Inc. (PAL), Pawtucket, Rhode Island, June 2014.

Project Information: Deepwater Wind Block Island, LLC, a wholly-owned indirect subsidiary of Deepwater Wind Holdings LLC (DWBI), proposes to develop the Block Island Wind Farm (BIWF), a 30 megawatt offshore wind farm comprised of five wind turbines located approximately 3 miles south east of Block Island (Town of New Shoreham), Rhode Island. The BIWF is subject to permitting by the U.S. Army Corps of Engineers (USACE) and is therefore required to comply with Section 106 of the National Historic Preservation Act of 1966, as amended (16 U.S.C. 470f, the NHPA). USACE, in consultation with the U.S. Department of the Interior National Park Service and the Rhode Island State Historic Preservation Office (RISHPO), has determined that construction of the BIWF will result in an adverse effect to the visual setting and cultural landscape of Block Island Southeast Light, an historic property that is a designated NHL and is listed in the National Register. PAL prepared this addendum to the Southeast Light HAER No. RI-27 documentation to mitigate the adverse effects of the BIWF. Robert Brewster of Warren Jagger Photography, Inc., Providence, Rhode Island, completed the archival photography of the structure on May 20–21, 2015. Virginia H. Adams served as PAL project manager.

Part I. Historical Information

A. Physical History:

1. Dates of construction: see 1988 HAER documentation

2. Engineer: see 1988 HAER documentation

3. Builder/Contractor: see 1988 HAER documentation

4. Original plans and construction: see 1988 HAER documentation

5. Alterations and additions:

This section describes the major alterations and additions that have taken place to Southeast Light since the original HAER documentation was completed in 1988. Alterations and additions that occurred prior to 1988 are described in the 1988 HAER documentation.

In 1990, the U.S. Coast Guard (USCG) removed a fog horn sound signal that had been installed on the tower in 1974 from the lighthouse and relocated the instrument to a concrete pad backed by a sound baffle at the edge of Mohegan Bluffs. The USCG demolished the Fog Signal Building Engine House at this time in order to prevent any "dead spots" within the sound pattern broadcasted to the ocean.[3]

In 1993, the USACE oversaw a relocation of the lighthouse away from the edge of Mohegan Bluff to avert the building's imminent destruction from the natural forces of cliff erosion. International Chimney Corporation (ICC) of Buffalo, New York, was general contractor for the move, and Expert House Movers of Maryland, Inc. executed the move itself. The lighthouse was relocated 245′ north-northwest onto a new foundation with its historical orientation preserved exactly. As a component of the move design, the lower two-thirds to three-quarters of the historic brick foundation was left behind and back filled in-situ, and a new brick foundation supported by an 18″-thick concrete slab was built. The new foundation has the same partitioned wall configuration as the historical design in order to support load bearing interior walls. The granite ashlar water table of the lighthouse was preserved with exactly the same above-grade exposure as in its historical location.[4]

Stabilization and restoration work was undertaken from 1993–1994 on the exterior of the building in support of the move to stabilize the structure and allow its essential functions to continue after the move. The exterior brickwork was almost entirely repointed, and non-historic steel fire escapes were removed. The formerly enclosed north porch was reopened as it was originally, and a handicapped ramp was added

[3] R.F. Riley, Supervisor, Shore Maintenance Detachment, NY; written correspondence with Richard Greenwood, Environmental Review Coordinator, Rhode Island historical Preservation Commission; USCG, "Memorandum of Agreement between the Shore Maintenance Detachment–New York, United States Coast Guard, the Rhode Island State Historic Preservation Officer, and the Advisory Council on Historic Preservation" (Executed January 6, 1989).
[4] Tom Keyser, "Md. Mover Shines Under Beam of R.I. Lighthouse" (*Baltimore Sun*, August 26, 1993), 1; Mike E. Prible, "Case Study: Relocation of the Block Island Southeast Lighthouse," in Historic Lighthouse Preservation Handbook, National Park Service (Washington, D.C.: National Park Service, 1997), V-18–V-22; USACE, "Solicitation No. DACW33-92-R-0003, Section C–Project Description, Specifications, Work Statement, Volume 2" (USACE, New England Division, 1992), C-6.

to the southeast porch. The porches on the southeast and southwest corners of the building were reconstructed with new framing below the deck level to replace non-historic framing that was removed in preparation for the building move. New porch decking with bullnosed ends was installed to replicate the historic decking, which was not extant at the time of the move.[5] On the lighthouse tower, the lantern gallery deck handrail was replaced and severely deteriorated plate sections of the watch level and lantern gallery decks and related structural supports were repaired or replaced as necessary. All cast iron components extending from the watch (aka observation) deck to the top of the tower were sandblasted, sanded, and repainted.[6]

In 1994, near the conclusion of the 1993–1994 move and related restoration, the USCG replaced the 1929 Fresnel lens and associated mercury float pedestal with a new fixed first-order Fresnel lens (described in Part II.C below).[7] The lantern gallery's 48 plate glass wall panels were replaced with new shatter-resistant glass. International Chimney, Inc. modified the lens pedestal to receive the new lens by removing two of its five segments, refurbishing the remaining three, and fabricating a new floor grate.[8]

Beginning in 2000, the Southeast Lighthouse Foundation, with the assistance of preservation architects Newport Collaborative Architects of Newport, Rhode Island, developed a rehabilitation plan to restore the exterior and interior of Southeast Light and convert the lighthouse keeper's quarters to a bed-and-breakfast and museum. The work was designed to comply with the Secretary of Interior's *Standards for the Treatment of Historic Properties* and to be completed in three phases, of which Phases I and portions of Phase II have been finished.

From the 2003 to 2004, the Southeast Lighthouse Foundation's contractor Yankee Steeplejack Company (aka YSC, Inc.) of Harvard, Massachusetts, completed the exterior restoration of the keeper's quarters (Phase I of the rehabilitation plan). A new slate roof and flashing were installed on all the building's gable roofs and the granite coping stones on the residence's gable rakes were removed to permit the installation of flashing and then reset in their original locations. In isolated instances, degraded coping stones or ends thereof were replaced in-kind or new iron pins or cramps were installed. The three porches were restored to their original appearance using new wood porch balusters and posts up to the porch brackets, and the brackets were repaired. The porch roofs were sheathed in copper and new copper gutters were installed. The southeast handicapped ramp added in 1993 was replaced. All of the original windows were

---

[5] Walter Sedovic, Architect, written communication with Joseph Jakubik, Project Manager, International Chimney Corporation, October 29, 1993.

[6] Tanya Contos, "Traveling Light" (*Block Island Times* August 27, 1994), 7; Lisa D. Nolan, Executive Director, Southeast Lighthouse Foundation, personal communication with John Daly, PAL, May 20, 2015; Prible, "Case Study: Relocation of the Block Island Southeast Lighthouse," V-18–V-22; Sedovic, written communication with Joseph Jakubik, October 29, 1993; USACE, "Fact Sheet: Southeast Lighthouse, Block Island, R.I." (Waltham: USACE New England Division, 1994), 4; USACE, "Solicitation No. DACW33-92-R-0003, Section C–Project Description, Specifications, Work Statement, Volume 2", C-12.

[7] The 1929 lens unit is in storage at the facility of the USCG Aids to Navigation Team, Bristol, Rhode Island. It may be returned for inactive display at the Southeast Light at such time as the Southeast Light restoration (described below) is complete.

[8] Two of the pedestal segments were removed because the replacement lens is larger than the 1929 lens it replaced. Tanya Contos, "Traveling Light" (*Block Island Times* July 16, 1994) 11; Contos, "Traveling Light" (*Block Island Times* August 27, 1994), 7; Nolan, personal communication with John Daly, May 20, 2015; Prible, "Case Study: Relocation of the Block Island Southeast Lighthouse," V-18–V-22; USACE, "Fact Sheet: Southeast Lighthouse, Block Island, R.I.," 4.

rehabilitated. Exterior doors were repaired and rotted or otherwise irreparable doors were replaced with wood replicas. The chimneys were restored to their original height and profile.[9]

Interior restoration (still in progress) of the keeper's quarters commenced in late 2003.[10] The late-twentieth century (non-historic) floor, wall, and ceiling coverings and fixtures were removed.[11] Nearly all the original plaster on the exterior walls was found to be irretrievably damaged due to moisture infiltration and was removed. Brick pointing behind these surfaces was also found to be failing and was repointed. Wood trim from these walls has been preserved in temporary storage. Interior woodwork was stripped and primed to abate lead-containing coatings. Modest changes were made to the floor plan. An early-twentieth-century bathroom and partitions were removed from the first and second floor of the hyphen between the residence and the tower to restore the original floor plan. The doorway and surrounding brick wall between the tower hyphen and the residence vestibule on the first floor was removed and replaced with a stud partition. Stud partitions were begun in the second floor north bedrooms for bathrooms. A fire door was cut between the two sides of the second floor living areas at the bottom of the basement stairs and an adjacent closet for one of the second floor keeper's bedrooms was removed. The rehabilitation also included the framing of a new restroom in the keeper's kitchen.[12]

B. Historical Context:

This context statement provides a discussion of the Southeast Light's cultural landscape and its status therein, followed by a history of the lighthouse from 1988 to 2015.

Southeast Light and the Landscape of Block Island

Southeast Light has a dramatic location atop the Mohegan Bluffs at the southeast corner of Block Island that makes it a striking visual anchor within the unique landscape of the island, and which has given it great importance as a local landmark and has contributed to the heritage and tourist economy of the island. The historic development of Block Island (Town of New Shoreham) varies from established patterns of mainland coastal communities in New England because of its geography, isolated setting, and small scale. The island's lack of a natural harbor delayed the pace of development until the late nineteenth century. Once intensively settled, the physical appearance of Block Island evolved through three distinct phases of land use and human interaction with the natural environment, consisting of colonial clearing and partitioning of lands, modification of the agrarian landscape by maritime and tourist interests, and

[9] Dr. Gerald F. Abbott, President, Southeast Lighthouse Foundation, written correspondence with Hampton Tucker, Acting Chief, State, Tribal and Local Programs, National Park Service, March 31, 2005; Nolan, personal communication with John Daly, May 20, 2015.
[10] The residence is a duplex divided longitudinally into symmetrical east and west halves by a party wall. The east half was traditionally assigned to the keeper, the west half shared by the first and second assistant keepers.
[11] As described in a 1989 *Condition Survey and Assessment*, these non-historic interior finishes largely consisted of plywood, linoleum, and carpet floor coverings; drywall, wood plank and vinyl wall coverings; drop and composite tile ceilings; and fluorescent light fixtures and other modern lighting appliances. The residence was in poor condition and there was severe water damage in some of its rooms at the time of the report. Walter Sedovic, *Condition Survey and Assessment with Recommendations: Preservation and Restoration of the Southeast Lighthouse, Block Island, Rhode Island* (Prepared by Walter Sedovic, Consulting Architect for the Maintenance and Logistic Command, Atlantic Shore Maintenance Detachment, New York; Governors Island, NY, 1988).
[12] Olga Bachilova, Historic Preservation Project Manager, Newport Collaborative Architects, Inc., written correspondence with Hampton Tucker, Acting Chief, State, Tribal and Local Programs, National Park Service, December 21, 2004; Nolan, personal communication with John Daly, May 20, 2015.

finally, abandonment and re-vegetation of farmlands. The physical imprint of this land use was overlaid upon a unique island topography that was a result of the geological processes that formed the island.[13]

Block Island is a terminal glacial moraine lying approximately 13 miles south of mainland Rhode Island and 14 miles east of the eastern tip of Long Island. Block Island Sound lies to the north and west of the island; the Atlantic Ocean to the south, and Rhode Island South to the east. The island was formed through the emplacement of two direct sequences of glacial deposits consisting of glacial deposition, structural deformation by advancing ice, and post-glacial changes (mainly due to groundwater). Although the timing of the glacial maximum in southern New England is not certain, it is likely that the Laurentide ice sheet reached its maximum between 25,000 and 21,000 years ago, covering all of Rhode Island south to the Ronkonkoma-Block Island-Martha's Vineyard Moraine. This episode deposited a drift sheet composed of sedimentary layers of glacial till and outwash. Following 21,000 years ago, glacial ice began its slow contraction through episodic growth and retreat that ultimately resulted in the deglaciation of Rhode Island by approximately 15,000 years ago. In one of the ice sheet's periodic advances, the first drift sheet was dislodged and thrust southward in blocks, then engulfed in outwash and till (a dense assortment of silt, sand, gravel, and stone). The dislodged and engulfed blocks have given Block Island a distinctive undulating topography that is likened to waves. In post-glacial time, groundwater infiltrated the glacial deposits and ponds have formed as temporary perched water atop the less permeable lower drift strata. The moraine formation associated with Block Island extends under the present sea level as broad shoals up to 5 miles to the south and east of the island. These shoals, subject to littoral forces, created a shallow and ever-changing ocean bottom that would be highly dangerous to ships in the historic period.[14]

Known by the Narragansett Native Americans tribe as Manisses (meaning "Island of the Little God"), Block Island was rechristened after the landing on the island of Dutch trader Adrian Block in 1614. Sixteen Massachusetts proprietors obtained title to the island in 1660 for the purpose of establishing a plantation, after which time the island was permanently settled. The proprietors divided the island into 60 lots, with an allotment for common land around Great Salt Pond. They partitioned the southern end of the island, including the future lighthouse site into long, east-west running rectangular parcels whose inland ends terminated at or near present-day Center Road and Lakeside Drive and thus created a long-held distinction between the 'East Side' and 'West Side'. Some lines of these original divisions may still be discerned in contemporary aerial photos as walls and transitions in vegetation types. Each landowner was provided with a strip of meadowland, land with access to fresh water, and an allotment along the coast.[15]

Late-seventeenth-century settlers rapidly cut trees for building construction and fuel and transformed the dense forests that had covered the island into open pastureland divided by a distinctive network of stone

---

[13] Everett Associates, Inc., *Historical and Architectural Resources of Block Island: A Preliminary Report* (Prepared for the Rhode Island Historical Preservation Commission, Providence, RI by Everett Associates, Inc., 1987), 21.
[14] Les Sirkin, *Geotechnical Report: Block Island Southeast Lighthouse Property* (Garden City: By the author, 1989), 1.
[15] Virginia H. Adams, et al., *Block Island Wind Farm and Block Island Transmission System, New Shoreham Above-Ground Historic Properties Identification, National Register Eligibility Evaluation and Preliminary Effects Assessment, Charlestown, Jamestown, Little Compton, Narragansett, New Shoreham, Newport, South Kingstown, and Westerly, Rhode Island* (PAL Report No. 2628.02, Submitted to Deepwater Wind, Providence, RI, 2012), 20; Everett Associates, Inc., *Historical and Architectural Resources of Block Island: A Preliminary Report*, 10-11; S.T. Livermore, *A History of Block Island* (Hartford: The Case, Lockwood & Brainard Co., 1877), 163.

walls and fences that characterized the landscape into the late nineteenth century. Subsistence-based fishing and agriculture supported the island's small population through the mid-nineteenth century. After approximately 60 years of continuous tree-clearing, the town feared that a lack of native fuel would cause abandonment of the island, and, in 1721, passed an ordinance prohibiting the cutting of timber for fuel and limited the height of fences to a maximum of 4′. After this date, residents relied on peat (referred to as 'tug') as a domestic fuel source and constructed specialized outbuildings known as peat houses to aid in its drying and storage.[16]

While limited regional maritime trading continued through the eighteenth century, the absence of a harbor that could accommodate large vessels prevented the growth of commercial fishing and maritime commerce. Local farmers typically grew crops of rye, barley, oats, and potatoes in addition to raising livestock and producing subsistence amounts of milk, eggs, and cheese. The use of seaweed for fertilizer resulted in the creation of 'seaweed lanes', private, deeded access ways between farms and the coastal beaches. Development of farm estates continued gradually during the nineteenth century, but the absence of a historic village settlement or town common encouraged a dispersed pattern of growth. An informal town center emerged at the junction of the intersection of Beacon Hill and Old Town roads, the island's earliest primary roads, by 1850. The south end of the island was sparsely populated in comparison to the rest of New Shoreham—with only one resident within about ¼ mile of the future lighthouse through the 1870s. By the late nineteenth century, Block Island had a distinct agrarian landscape derived from the confluence of geological and man-made features that was described in one late-nineteenth-century history of the island as "almost invariably composed of undulating pastures, studded with picturesque homes, barns and haystacks, the most of them commanding glimpses of the sea" and "massive and interminable stone walls…[that] intersect the entire island…"[17]

The island's distinctive appearance is supposed to have repelled, rather than attracted outside visitors before the 1870s, who were put off by the "destitution of trees, its unpretentious buildings, its shores unfrequented by shipping".[18] However, Block Island's economy and landscape began to evolve in the 1870s after the successful creation of 'Government Harbor' (now Old Harbor) on the east side of the island with funding from the U.S. Congress. Maritime access to the west side of the island was provided with the creation of New Harbor, constructed at Great Salt Pond from 1894 to 1898. The island's permanent population had peaked at 1,500 people in 1900. The harbors facilitated the growth of commercial fishing in the late-nineteenth-century, and, more importantly for the future of the island, regional tourism, which had increased throughout New England during the late twentieth century as a result of urbanization and transportation improvements. Steamer service brought passengers from regional ports in New York, Rhode Island, and southeastern Connecticut to Block Island, where they found

---

[16] Adams, et al., *Block Island Wind Farm and Block Island Transmission System, New Shoreham Above-Ground Historic Properties Identification, National Register Eligibility Evaluation and Preliminary Effects Assessment, Charlestown, Jamestown, Little Compton, Narragansett, New Shoreham, Newport, South Kingstown, and Westerly, Rhode Island*, 20; Joseph N. Waller Jr. and Kate Johnson, *Phase I(c) Archaeological survey, Block Island Wind Farm and Block Island Transmission System Project, Narragansett and New Shoreham, Rhode Island* (PAL Report No. 2628.02/.03. Submitted to Tetra Tech EC, Inc., Boston, MA, 2012), 27-28.

[17] Adams, et al., *Block Island Wind Farm and Block Island Transmission System, New Shoreham Above-Ground Historic Properties Identification, National Register Eligibility Evaluation and Preliminary Effects Assessment, Charlestown, Jamestown, Little Compton, Narragansett, New Shoreham, Newport, South Kingstown, and Westerly, Rhode Island*, 20, 24; Charles Lanman, "Block Island" (*Harper's New Monthly Magazine* 1976) as quoted in Everett Associates, Inc., *Historical and Architectural Resources of Block Island: A Preliminary Report*, 22.

[18] Livermore, *A History of Block Island*, 228.

accommodations in newly built ocean-view hotels. Rapid development of land on the island for hotels, inns, boarding houses, and private residences occurred; especially near Old Harbor, which emerged as the island's commercial center. Perceptions of the island's Spartan landscape changed as well, as it was re-codified via various cultural productions into iconic images of local 'scenery' through the reflective process of place-making common to tourist locales. The island's late-nineteenth-century historians Beckwith (1858), Lanman (1876), Sheffield (1876), and Livermore (1877); photography of island scenes beginning about 1870-72; and sketch vignettes of the rural landscape all captured the historic landscape and began to recast the island's landscape as a tourist attraction. The number of hotels on the island peaked at about 30 (accommodating approximately 3,100 guests) before the onset of World War I, then declined until the late twentieth century.[19]

Much of the development of the island's new economy occurred within a parallel timeframe to improvements in navigational infrastructure, including Southeast Light. Block Island's hazardous offshore areas were a constant threat to coastal shipping, which was a critical component of national trade up until the late nineteenth century, as well as to development of Block Island's harbors and mainland-derived tourist economy. The earliest documented shipwreck in the island's vicinity was perhaps the *Palatine* in 1755, an incident immortalized by the noted American poet John Greenleaf Whittier. Some nine additional wrecks would follow, including the *Palmetto*, whose loss on Black Rock off the southeast corner of the island precipitated the construction of Southeast Light. The island's first lighthouse was erected at Sandy Point on the north end of the island in 1829 and replaced with the extant North Light in 1867. Construction of life saving stations on Block Island began with the Cooneymus Road station in 1872 (replaced 1886), followed by Government Harbor station in 1874, Crescent Beach station in 1890, and Sandy Point station in 1900. After the U.S. Coast Guard consolidated the U.S. Life Saving Service in 1915, the U.S. government erected a Coast Guard Station at Great Salt Pond in 1935. In 1903, the U.S. Weather Bureau completed a detailed survey map of the island, including the locations of weather signal flags posted to aid maritime travel and navigation.[20]

With the coincidence of lighthouse construction and tourist development, Southeast Lighthouse was perhaps destined to become an important landmark when completed in 1875. The lighthouse is the highest in New England, with an elevation at 150′ above sea level, and when completed stood 300′ back from the Mohegan Bluffs behind an apron of close-cropped meadow. The bluffs descended in a steep craggy, polychrome slope to the waters of Block Island Sound and the Atlantic Ocean, which extended in an uninterrupted expanse to the south horizon. Architecturally, the lighthouse offered a striking and handsome Romantic-Period Victorian Gothic design. The compact form of the lighthouse and attached keepers cottage conveyed an image of strength and fortitude, while the rising verticality of its design provide a strong contrast to the descending bluffs. Behind the lighthouse spread the tidy, but idiosyncratic

---

[19] Adams, et al., *Block Island Wind Farm and Block Island Transmission System, New Shoreham Above-Ground Historic Properties Identification, National Register Eligibility Evaluation and Preliminary Effects Assessment, Charlestown, Jamestown, Little Compton, Narragansett, New Shoreham, Newport, South Kingstown, and Westerly, Rhode Island*, 22-24; Robert M. Downie, *The Block Island History of Photography. Volume 1 – 1870-1910s* (New Shoreham: Block Island History, 2007); Everett Associates, Inc., *Historical and Architectural Resources of Block Island: A Preliminary Report*, 22; Livermore, *A History of Block Island,* 228.

[20] Adams, et al., *Block Island Wind Farm and Block Island Transmission System, New Shoreham Above-Ground Historic Properties Identification, National Register Eligibility Evaluation and Preliminary Effects Assessment, Charlestown, Jamestown, Little Compton, Narragansett, New Shoreham, Newport, South Kingstown, and Westerly, Rhode Island*, 22; Samuel T. Livermore, *Block Island* (Hartford: The Case, Lockwood & Brainard Company, 1882), 112-139.

vernacular landscape of Block Island that was summarized in Lanman's 1876 description. At the time, the land rolled up to the foot of the lighthouse as a series of grassy waves broken into a warren of pasture and tilled fields interspersed with kitchen gardens and small ponds. Just a handful of wood cottages lay near the lighthouse. These were grouped in clustered farmsteads and were concentrated to the north of Payne Pond along current-day Seaweed Lane and to the northeast along Mohegan Trail (aka Spring Street).[21]

Southeast Light became a tourist attraction immediately upon opening. It was quickly listed in tourist guides as a major point of interest and its image appeared on souvenir items and in prints and photographs. The first known image of the lighthouse was published in *Harper's Magazine* (then *Harper's New Monthly Magazine*) in July 1876, just 17 months after the lighthouse was lit. Nineteenth-century tourists and journalists flocked to the site to visit the lighthouse, and President Grant visited the structure in 1875.[22] A local historian recounted just two years after the opening of the lighthouse: "[The lighthouse] is examined with interest by multitudes of summer visitors, who are courteously waited upon by the keeper, although he is not required to do this by the government".[23] Visitors were presented with a dramatic scene that was a product of the lighthouse's spare setting in the isolated southeast corner of the island; the contrast between the ocean and bluffs, and the proximity of the lighthouse to the bluffs. Climbing the tower, visitors would be rewarded with an even more expansive and omniscient view that allowed them to take in both the island's picturesque agricultural landscape and the infinite seascape. Thus, a visit to the lighthouse fit well within the romantic tradition of tourism in the late nineteenth century, which sought dramatic and picturesque natural environments that could invoke feelings of awe or the sublime by contrasting humanity's relative unimportance with the scale of God's works. Simultaneously, it presented an engineering marvel in the form of the Fresnel lens that played to the country's rising national self-consciousness and pride in its public works and industrial achievements. The attractions of both the lighthouse and its surrounding cultural and natural landscape, and the aesthetic value produced by the resonances between the two, was neatly described and pictured in Samuel T. Livermore's 1882 *Block Island*, which contained both a guide and history of the island (see attached illustrations):[24]

> The new lighthouse is situated on the southeast corner of the island…and the light conspicuous far at sea. It stands on a bluff 120′ above mean low water…[the lantern] has been seen thirty-five miles…Aside from the attractions of the new lighthouse itself…the landscape scenery there, and while going and coming, and the extensive view out upon the ocean well repay the visitors. The route there from the harbor is southerly, up High

---

[21]Downie, *The Block Island History of Photography. Volume 1 – 1870-1910s*, 27, 61, 240; Everts and Richards, *Block Island, New Shoreham* (Philadelphia: Everts and Richards 1895).

[22] It is appropriate that one of the leading advocates for construction of a lighthouse at this location was tourist entrepreneur Nicholas Ball, who wished to increase the safety of navigation around the island but unwittingly (or perhaps not) created one of the island's great tourist attractions. The distinctive and elevated architectural character of Southeast Light is attributed by some historians (Reynolds 1995) to a desire on the part of the Light House Board to provide an attractive building for a locale that would likely be visited by vacationers. President Grant's endorsement of the building is interpreted in this narrative as both a confirmation of such a theory and an affirmation of the Light House Board's success in this regard. Andrea R. Reynolds, "Block Island South East Light, New Shoreham, RI" (National Historic Landmark Nomination Form, 1995), 14, 16.

[23] Livermore, *History of Block Island*, 206.

[24] Downie, *The Block Island History of Photography. Volume 1 – 1870-1910s*, 27; Reynolds, "Block Island South East Light, New Shoreham, RI", 16-17; Martha Smith, "The Rescued Light," *The Rhode Islander Magazine*, August 21, 1994:12-15.

> Street and by Dodge Street nearly to Sands Pond, thence easterly by cart track and gates across several farms.[25]

The expansion of Block Island's summer economy in the modern period has impinged on the island's and the lighthouse's landscape and setting, although its historical and geographical origins are still very much in evidence. After World War II, the island's tourist economy and year-round population contracted, reaching a low of 486 in 1960. The economy then rebounded as access to the island improved with the completion of the Block Island Airport in 1950 and a vacation home construction boom occurred during the late twentieth century. This was aided by improvements in ferry capacity that allowed cement trucks to reach the island for the first time on common carrier vessels. The island's permanent population has expanded to just over 1,000 and reaches over 10,000 people in the summer season. The associated new construction and land divisions for development, along with the traffic associated with large numbers of seasonal tourists, threatened the loss of the island's nineteenth-century landscape. A secondary effect of seasonal development of former agricultural lands has been the reclamation of open fields by shrubs and trees that altered some of Block Island's historic, open views. This evolution has claimed a number of the open fields that could formerly be seen from the lighthouse tower to the north and northeast. However, the development has also inspired the creation of local land conservation movements, namely the Block Island Conservancy (BIC, founded 1972), which, together with non-profit, and local, state, and federal government partners, has contributed to the retention of approximately 40 percent of Block Island's land as preserved open space. The Rhode Island Department of Environmental Management (RI DEM) has preserved a large section of the Mohegan Bluffs immediately west of the lighthouse. The Nature Conservancy recognized Block Island's uniqueness in 1991, designating it one of the "Last Great Places" in the western hemisphere. Related efforts to retain Block Island's resources involved the incorporation of the Block Island Historical Society in August, 1942. In this context, the effort to preserve Southeast Light (described below) is one of a continuum of public-private partnerships to preserve elements of Block Island's historic cultural landscape. The lighthouse's seaward viewshed has been preserved by the inaccessibility of the bluffs themselves, whose topography and rugged nature preclude development of the coastal zone.[26]

The Southeast Light remains an integral part of the Block Island's heritage landscape and thus its economy, which relies heavily on tourist income. The lighthouse and Mohegan Bluffs are popular destinations on the island, and about 3,000 visitors come to the lighthouse each month of the tourist season. Southeast Light serves as a symbol of Block Island's and Rhode Island's maritime locale, geography, and history. Photographs of the building continue to be widely reproduced in popular publications with a national audience, as well as in official promotional literature for Rhode Island tourism. For residents of the island and mariners of the region, the lighthouse's status in the landscape is

---

[25] Samuel T. Livermore, *Block Island*, 10-12.

[26] Adams, et al., *Block Island Wind Farm and Block Island Transmission System, New Shoreham Above-Ground Historic Properties Identification, National Register Eligibility Evaluation and Preliminary Effects Assessment, Charlestown, Jamestown, Little Compton, Narragansett, New Shoreham, Newport, South Kingstown, and Westerly, Rhode Island*, 25, 28; Edward F. McGovern Jr., First Warden, Town of New Shoreham, written correspondence with Captain Norman Edwards, Chief, Aids to Navigation Division, First Coast Guard District, Boston, MA; April 20, 1990.

imbued with additional value. For these groups, the building is a sentinel and a significant landmark for departures or homecomings that is embedded in the community's collective consciousness.[27]

Lighthouse History, 1988–2015

As of 1988, the possibility of the Southeast Light falling into the sea because of ongoing coastal erosion of Mohegan Bluffs had become a critical threat to the lighthouse's existence. Rising public awareness on the part of Block Island's permanent and summer residents, as well as interest on the part of public officials in state government precipitated a search to find a way to save the property. At this time, Southeast Lighthouse was owned by the USCG and operation of the property was administered through the USCG's Short-Range Aids to Navigation Program—one of four programs administered by the Office of Navigation.[28]

The incipient threat to the Southeast Light coincided with a heighted national discourse concerning the historic role that lighthouses had played in U.S. coastal navigation and a renewed appreciation of the buildings as landmarks in the country's coastal landscape. The USCG had been steadily automating lighthouses during the second half of the twentieth century to make operations more cost effective and reduce maintenance requirements for antiquated lighthouse structures. The automation effort was accelerated and many lighthouses were designated for demolition or transferred out of USCG ownership in the 1970s and 1980s due to persistent funding shortfalls. At the same time, however, the USCG was preparing for the 200th anniversary of the creation of the U.S. Lighthouse Service in 1889. In response, a coalition of lighthouse preservationists and supporters established in 1988–1989 the National Bicentennial Lighthouse Fund that provided grants to non-profits that were preserving lighthouses. Congressional hearings were also held on lighthouse management that led to policy changes in the way that the buildings were managed by the USCG. Popular publications such as *Life* magazine published articles on lighthouse preservation that underscored the political and environmental forces that were threatening lighthouse survival, as well as the preservation efforts underway to save them.[29]

Rhode Island, with its lengthy coastline and strong maritime heritage, had a robust interest in lighthouse preservation and also participated in the lighthouse "revival". In 1986, the *Sunday Journal Magazine* published an article about imperiled lighthouses in the state and, the same year, the state sponsored a traveling museum exhibit on lighthouses. Southeast Light, with its dramatic and imperiled cliff-side setting, was featured prominently in both national and local coverage of the lighthouse issue, including *Life* magazine's 1987 photo essay on the subject. Rhode Island Senator John H. Chafee was a sponsor of the National Bicentennial Lighthouse Fund.[30]

---

[27] McGovern, written correspondence with Captain Norman Edwards, April 20, 1990; Smith, "The Rescued Light" 15; USACE, "Solicitation No. DACW33-92-R-0003, Section C–Project Description, Specifications, Work Statement, Volume 2", C-2, C-3.

[28] USCG, *Lighthouses: Then and Now* (Washington, D.C.: USCG, 1987), 1.

[29] The HAER also contributed to the wave of lighthouse preservation and commemoration effort. The 1988 HAER recordation of Southeast Light was the inaugural documentation for a HAER project to record significant lighthouses in honor of the 200th anniversary of the U.S. Lighthouse Service. Naomi Cutner, "The Great Lighthouse Giveaway" (*Life* August 1987), 36-40; Lighthouse Preservation Society, "Accomplishments"; Thomas, "Block Island Southeast Light," 39; USCG, *Lighthouses: Then and Now*, 1, 15-16; Sarah J. Zimmerman et al., "Lighthouses of Massachusetts – Thematic Group Nomination, MA." (National Register of Historic Places Registration Form, on file, Massachusetts Historical Commission, Boston, MA, 1986).

[30] Naomi Cutner, "The Great Lighthouse Giveaway," 36-40; Gerald S. Goldstein, "Lighthouses: Our Heritage on the Rocks" (*Sunday Journal Magazine* March 9, 1986), 6-21.

Efforts to save Southeast Light began in the early 1980s under the leadership of Dr. Gerald Abbott, a summer resident of Block Island. The USCG initially opposed preservation of the light because of funding constraints, preferring instead to erect two additional ranch houses and an automated beacon on the bluffs as a replacement to the lighthouse once it became unsafe. The lighthouse would either be demolished or allowed to fall into the sea. Block Island residents, the Town of New Shoreham, and state officials in the Rhode Island Historical Preservation & Heritage Commission (then Rhode Island Historical Preservation Commission) opposed this plan, wishing the lighthouse to be saved, and urged the USCG to exercise its responsibility to preserve the landmark lighthouse as an essential piece of Rhode Island history and heritage.[31]

In response, Abbott and other residents established a working group under the auspices of the Block Island Historical Society and commenced negotiations with the USCG. A National Register of Historic Places (National Register) nomination was prepared for the lighthouse in 1984 in order to have the building formally recognized as an historic property deserving protection.[32] In 1985, the working group obtained grant funds from the National Trust for Historic Preservation's Antoinette F. Downing Preservation Services Fund for Rhode Island and used the monies to complete the Southeast Lighthouse Planning Study, which established the feasibility of and a basic plan for saving the property from destruction. The study, completed by LeMersurier Associates in 1985, concluded that moving the lighthouse, as opposed to slope stabilization, was the best course of action to preserve the building. In 1986, Abbott's group amicably separated from the Block Island Historical Society to form the Block Island Southeast Lighthouse Foundation and obtained a lease for the lighthouse and accompanying ranch house from the USCG. There was a growing recognition for all parties involved that the USCG, as a federal agency whose primary responsibility was maintenance of navigational aids, was not the appropriate institution to take charge of a complex project such as moving a lighthouse.[33]

Support for the relocation of the lighthouse built over the next two years, while the USCG continued to plan for the automation of the light. The USCG's initial plan was to remove the Fresnel lens from the light tower after erecting a new beacon on a free-standing steel tower. In the summer of 1988, a compromise was reached wherein the USCG would deactivate the lens but leave it in place. In anticipation of the automation, and possibly the destruction of the lighthouse, the USCG sponsored the HAER recordation of the property in 1988.[34]

---

[31] Robert L. Bendick Jr., Director, State of Rhode Island Department of Environmental Management; written correspondence to Senator Claiborne B. Pell, U.S. Senate, December 15, 1986; Edward F. Sanderson, Executive Director and Deputy State Historic Preservation Officer, Rhode Island Historical Preservation Commission; written correspondence with Lauren Boudreau, Realty Specialist, First U.S. Coast Guard District, Boston, MA, September 22, 1986.

[32] The property was formally listed in the National Register in 1990.

[33] Block Island Historical Society, Grant Application—National Trust for Historic Preservation's Antoinette F. Downing Preservation Services Fund for Rhode Island (New Shoreham: Block Island Historical Society, awarded March 1985); N.C. Edwards Jr., *Block Island Southeast Light: A Strategy for Preservation and Public Access* (Boston: Aids To Navigation Branch First Coast Guard District, 1990), 1; Rudy J. van Leeuwen, "Report on Southeast Light, Block Island, Rhode Island" (Cambridge: LeMessurier Associates, Inc., 1985); Southeast Lighthouse Foundation, "News Release for Saturday, August 27th, 1994" (New Shoreham: Southeast Lighthouse Foundation, 1994).

[34] Robert T. Rufe, Jr., Captain, USCG; written correspondence with Senator Clairborne Pell, U.S. Senate, June 7, 1988; Mary M. Thomas, "Block Island Southeast Light."

In October 1988, Senator Chafee, an active proponent of federal lighthouse preservation, introduced legislation to transfer ownership of Southeast Light from the USCG to the Southeast Lighthouse Foundation at such time as the foundation was prepared to receive the property. Chafee, in his remarks introducing the bill, called the lighthouse "the most recognizable symbol of Rhode Island."[35] Rhode Island representative Claudine Schneider of the U.S. Congress supported the bill. The legislation did not pass in 1988, but was reintroduced successfully in the 1989 legislative sessions, during which it was approved as the Southeast Lighthouse Preservation Act of 1989. To further efforts for preservation of the lighthouse, the bill contained a stipulation mandating that the USCG prepare a strategy for the preservation of and continued public access to the light. The strategy, published in 1990, solidified the effort as a public-private partnership that would include the Southeast Light Foundation working with local, state, and federal agencies. Meanwhile, the Southeast Lighthouse Foundation initiated its private effort to move the lighthouse by commissioning a preservation and restoration feasibility study, accompanied by a geotechnical report, completed in 1989.[36]

The National Trust for Historic Preservation lent additional impetus to the lighthouse preservation effort by placing the Southeast Light on its annual list of 'America's 11 Most Endangered Historic Places' in 1990 and 1991. On July 7, 1990, the USCG automated Southeast Light. The beacon in the light tower was deactivated and a new beacon on a metal tower (now removed) north of the lighthouse was turned on. An official USCG ceremony was held to mark the event and used by the Southeast Light Foundation as a means to raise public awareness for the preservation project. At the time, the Southeast Light was Rhode Island's last manned lighthouse and one of only three manned lighthouses in New England.[37]

Preservation of the lighthouse became certain when Senator Chafee succeeded in obtaining funds for the building's relocation through the federal Water Resources Development Act of 1990 (Public Law 101-640, dated November 28, 1989). The act allocated $970,000 in federal money for the relocation of the lighthouse and designated the USACE as the agency responsible for the effort. Matching funds were to come from state and private sources. Ultimately, the State of Rhode Island and the Southeast Light Foundation contributed $970,000 for the move, with $700,000 coming from the state and the remainder from the Southeast Light Foundation. With funding for the move secure, the USCG transferred ownership to the Lighthouse Foundation in May 1991, with a formal transference ceremony held June 1, 1991.[38] The Southeast Lighthouse Foundation in turn passed the property to the state Department of Environmental Management in February 1993 for the duration of the relocation, in order that the project would be eligible for state financial assistance. The USCG retained responsibility for maintaining a navigation

---

[35] John H. Chafee, "Statements on Introduced Bills and Joint Resolutions" (*Congressional Record* 134 (145)— October 13, 1988), 1,

[36] *Block Island Times*, "Schneider Seeks House Appropriation for Southeast Light Rescue Effort" (*Block Island Times* May 5, 1990), 5; John H. Chafee, "Statements on Introduced Bills and Joint Resolutions," 1; Edwards, *Block Island Southeast Light: A Strategy for Preservation and Public Access*, 2; Irving B. Haynes and Associates, *Final Project Report: Preservation and Restoration Feasibility Study, Southeast Lighthouse, Mohegan Bluffs, Block Island, RI* (Providence: Irving B. Haynes and Associates, 1989)*; Providence Journal*, "Chafee Moves to Preserve Block Island Lighthouse" (*Providence Journal*, February 25, 1989), Un-paginated clipping on file, Southeast Lighthouse Foundation; Sirkin, Geotechnical Report: Block Island Southeast Lighthouse Property; U.S. Congress, "Southeast Lighthouse Preservation Act of 1989" (H.R.2428 — 101st Congress, 1989).

[37] Ron Cassinelli, "Comment Sought on Plan to Move Southeast Light" (*Providence Journal–Bulletin*, July 5, 1991:2); Richard Moe, "News Release: Statement on the Relighting of Block Island's Southeast Light" (Washington, D.C.: National Trust for Historic Preservation, August 27, 1994); USCG, "Block Island Southeast Light Automation Ceremony" (USCG program, July 7, 1987).

[38] The quitclaim deed filed in 1991 also included an historic preservation covenant held by the RIHPHC.

beacon and an easement to do so. Erosion, geotechnical, topographic, and structural studies were undertaken to determine the optimum location for the lighthouse, as well as necessary structural reinforcements for the building during and after its relocation. USACE planning for the move included an agreement with the RISHPO/RIHPHC and the Advisory Council on Historic Preservation to ensure that significant historic features of the property would be preserved.[39]

In February 1993, USACE awarded ICC the $1.93 million dollar contract for the lighthouse move. ICC, working with Pete Friesen, a noted consultant in the house-moving field, and Expert House Movers of Maryland, Inc., developed a plan for moving the entire lighthouse, complete with the attached masonry building and upper portion of the original foundation. The lighthouse, which was estimated to weigh 4,000,000 pounds, would be transferred onto a grid of crisscrossing steel beams and then pushed along steel I-beam tracks to its new location 245′ inland. Rather than moving the lighthouse directly, the building would be moved on a zig-zag course in three phases incorporating two 90-degree directional changes for a total distance of 360′. This course was selected to ensure the safety of the lighthouse—it aligned the thrust of the moving rams to be parallel with the shear walls of the building. Another key aspect of the move design was that the hydraulic jacks lifting the building would be operated as three separate zones to allow for compensation on uneven surfaces during travel without imposing stresses on the building.[40]

Preparations for the move ran from April to August 1993. The Fresnel lens was packed with sound- and vibration-dampening insulation. Fire escapes and porches were removed, with porch roofs left in place and braced. All mechanical equipment was removed from the basement. The building foundation was excavated and stabilized. Gunite (pneumatically applied concrete) was applied to the exterior and interior of the light tower foundation, a concrete compression ring was formed on the interior of its foundation, and the exterior face of the foundation was braced with a structural steel support framework. Cellar windows were bricked in, and the steel beam grid system was installed through saw cuts made in the foundation masonry. Wood bracing was installed in window openings and around chimneys, and 3/4″ diameter steel cabling wrapped around the entire structure.[41]

The lighthouse move proceeded between August 11 and August 24, 1993. Four hydraulic pushing rams slid the lighthouse in 5′ increments along the track, then were reset for the next push. After the lighthouse reached its new location, a 5′ gap between the historical foundation and the new reinforced concrete slab foundation was filled with brick walls and the steel crib removed. On completion of the move, wood bracing and other temporary measures were removed; porches were installed; and grading, landscaping, and final cleanup tasks completed. A large boulder uncovered during excavations for the move was

---

[39] *Block Island Times*, "Move to Take 7 Months" (*Block Island Times* February 27, 1993), 15; R.I. Rybacki, Rear Admiral, U.S. Coast Guard, Commander, First Coast Guard District; written correspondence with Dr. Gerald Abbott, Block Island Southeast Lighthouse Foundation; June 20, 1991; USACE, "Fact Sheet: Southeast Lighthouse, Block Island, R.I.," 2; USACE, "Memorandum of Agreement among the United States of America, Army Corps of Engineers, Rhode Island State Historic Preservation Officer and the Advisory Council on Historic Preservation Concerning the Relocation of Southeast lighthouse, Block Island, Rhode Island" (Executed July 9, 1991); USACE, "Solicitation No. DACW33-92-R-0003, Section C–Project Description, Specifications, Work Statement, Volume 2," C-3.

[40] Prible, "Case Study: Relocation of the Block Island Southeast Lighthouse," V-18–V-22; USACE, "Fact Sheet: Southeast Lighthouse, Block Island, R.I.," 4.

[41] The foundation of the lighthouse keeper's residence was found to be an un-mortared rubblestone structure, not the cut stone foundation as depicted in the original construction drawings. Prible, "Case Study: Relocation of the Block Island Southeast Lighthouse," V-18–V-22; USACE, "Fact Sheet: Southeast Lighthouse, Block Island, R.I.," 3.

placed at the former location of the lighthouse tower to mark the building's former location. Ownership of the lighthouse was then transferred back to the Southeast Lighthouse Foundation.[42]

The relocation of the lighthouse was a significant engineering achievement. The lighthouse was the first and heaviest (4 million pounds) brick lighthouse to be moved in the United States and was the first time that a nineteenth-century lighthouse was moved with its lens in place.[43] The engineering accomplishments and spectacular quality of the move attracted attention and made news nationwide, and the move was the subject of a film feature by National Geographic.[44]

Prior to the move, the USCG had intended that the 1929 beacon would be relit at the move's conclusion. However, the USCG instead chose to replace the lens and rotation mechanism because of the environmental hazard posed by the lens' mercury bearing device. The USCG initially proposed a modern electronic mechanism for the tower—an idea opposed by the Southeast Lighthouse Foundation. After an unsuccessful search for Southeast Light's original lens, USCG found an alternative Fresnel lens (described in Part II.C below) similar in design to the lighthouse's original 1875 lens. This was installed and activated in 1994 during an official relighting ceremony organized by the Block Island Historical Society and the Southeast Lighthouse Foundation and attended by local residents as well as dignitaries from the USCG, USACE, and State of Rhode Island.[45]

Following the move, the Southeast Lighthouse Foundation undertook efforts to restore the lighthouse. National Historic Landmark status was obtained for the property in 1997 (NRIS No. 97001264). In 2000–2003, the foundation obtained funds for restoration through several grants, including a Save America's Treasures grant administered through the National Park Service and Rhode Island State Preservation Grant. Exterior and interior restoration proceeded through 2004. Phase III of the rehabilitation was stalled by the economic contraction (aka the 'Great Recession') that followed the national banking crisis of 2008. The Southeast Lighthouse Foundation continues to provide tours of the building for the general public and temporary exhibits are installed in the base of the light tower.[46]

---

[42] Prible, "Case Study: Relocation of the Block Island Southeast Lighthouse," V-18–V-22; USACE, "Fact Sheet: Southeast Lighthouse, Block Island, R.I.," 4.
[43] USACE, "Fact Sheet: Southeast Lighthouse, Block Island, R.I.," 4.
[44] Stan Bicknell, "Block Island Lighthouse to be Moved to Safer Site" (*Engineering News-Record* April 19, 1993), 20; Peter Lord, "Lighthouse Move Rolls On" (*Providence Sunday Journal* July 25, 1993, C8; Peter Lord, "Southeast Lighthouse Safely Relocated" (*Providence Journal* December 6, 1993), 1.
[45] Block Island Historical Society and Southeast Lighthouse Foundation, "Relighting Ceremony: Southeast Lighthouse, Block Island, Rhode Island & Providence Plantations" (Photocopied ceremony program, 1994); Tanya Contos, "Traveling Light: How Block Island's Southeast Light Was Move Back from the Bluffs" (Pamphlet reprinted from *Block Island Times Articles* 1993–1994), n.p.; Lord, "Block Island Retreat, Southeast Lighthouse Safely Relocated", A-4.
[46] J. Michael Abbott and Olga Bachilova, *State Preservation Gran Final Report: Southeast Lighthouse* (Newport: Newport Collaborative Architects, 2010); National Park Service, "Grant Agreement No. 44-00-ML-1045" (Issued by the U.S. Department of the Interior, National Park Service, Washington, D.C. under the Save America's Treasures Grant Program—Public Law 106-113, June 1, 2002); Nolan, personal communication with John Daly, May 20, 2015; Edward P. Sanderson, Executive Director, RIHPHC, written correspondence with Dr. Gerald F. Abbott, President, Southeast Lighthouse Foundation, November 14, 2003.

Part II. Structural/Design Information

A. General Statement:

1. Character: see 1988 HAER documentation

2. Condition of fabric:

The exterior of Southeast Light is in excellent condition, due to the restoration completed in 2003–2004. The interior of Southeast Light is in fair or moderate condition, owing to the need to restore surfaces that were removed or partially restored during restoration activities in 2003–2004.

B. Description:

Southeast Light retains the general exterior design, massing, materials, and dimensions as described in the original HAER documentation of 1988. The following paragraphs describe new or altered architectural fabric on the lighthouse exterior, and provide a full description of the building interior (currently undergoing rehabilitation). A description of the lens is provided under Part II, Section C below.

Exterior

As described in Part I.5 above, the lighthouse keeper's residence porches are the only area where substantive changes have occurred to the exterior architecture of the lighthouse. All three porches (designated north, southwest, and southeast for convenience) have been restored to their original Gothic Revival design of polychrome wood construction, with some components being replicas of lost material.

The north (rear) porch faces north from between the two ells of the keeper's residence, which flank the porch on the east and west side. The two-bay wide porch echoes the symmetrical duplex arrangement of the residence and is divided by a north-south oriented wood privacy screen into two landings, each with its own flight of stairs, for the residence entries. The shallow-pitched roof is sheathed in sheet copper and supported on exposed rafters that have decorative quarter-round ends and chamfered lower corners. A gutter is integral with the drip edge of the roof and covered with an ogee-profile crown molding. The ceiling is painted tongue-and-groove planking. A heavy carved fascia runs across the edge of the roof to support the rafters and is supported by a chamfered post that rests on the porch deck. The fascia is assembled from a chamfered beam and two pairs of heavy, curved, paneled brackets, with each pair forming an arch over a stairway. The porch screen is supported by the roof post at its front edge and by a pilaster mounted on the north wall of the residence that echoes the post design. The screen is assembled from vertical planks surmounted by a heavy cap and ornamented with fretwork cut vertically between the planks. The porch railing consists of heavy, chamfered posts and cross-braced panels surmounted by pairs of round rails. The porch deck is painted planks. Plank stairs with open risers descend to grade and terminate at hammered granite stoops. Short flights of concrete stairs descend from grade to a landing below the porch, where a pair of wood panel doors provides access to the basement of the residence.

The southeast and southwest (front) porches are mirror images to each other. Each one-bay-by-two-bay structure projects from the interior corner formed by the intersection of the keeper's residence with the hyphen connection to the light tower. The design and ornament of the porches from the roof to the deck is identical to that of the north porch, except that the porch railings employ panels having turned balusters.

Below the deck, a wood plank fascia and lattice panels hide the underside of the deck, and the deck rests on brick piers. Each porch is accessed from grade by a short flight of hammered granite stairs. The deck of the southeast porch wraps around to the east side of the building as a handicapped ramp.

Interior

Keeper's Residence

As noted in the original HAER documentation of 1988, the keeper's residence is a duplex divided longitudinally (north-south) by a party wall, with each side being identical on all four floor levels. Only one half of the building (the east half of the duplex) is described in this section, except to note where conditions differ in the west half.

All four levels of the residence utilize a side-hall plan, with the stairs and accompanying hallway placed against the party wall of the building. On the first floor, a common foyer shared by both residences is located in both the first and second floors of the connecting hyphen between the residence and the light tower.

The first floor of the residence is divided by into three rooms (kitchen, dining room, and parlor; none of which are currently fitted as such), a stair hall, and an entry vestibule accessed by the common entry foyer in the connecting hyphen. Rooms were originally plastered on their ceilings and walls. Plaster and lathe have been removed from the ceilings, leaving the sawn joists exposed. Exterior brick walls, which were formerly coated with plaster, are now exposed. Interior partition walls are also brick and retain much of their plaster, which is applied directly to the brick without lathe. Door and window trim for the interior partitions consists of beaded plank surrounds with a stepped profile and ogee-profile backband. Some of the windows have a wood transom formed with a single panel framed with headers and stretchers. Door jambs are wide and assembled from panels to accommodate the thickness of the brick partitions. Baseboards, where not removed and in storage, have a stepped profile similar to the door and window surrounds and are topped with an ogee-profile molding. Trim around exterior doors and windows is now removed and in temporary storage. A brick chimney projects into the parlor and contains a brick fireplace with a segmental-arch lintel. Floors are a combination of temporary plywood and modern strip wood. The stairs rise from the first to the second floor in two flights separated by a 180-degree turn and landing. Stairs in the east residence retain an elaborate turned newel post and tapering turned balusters topped with a molded rail. Stairs in the west residence have had their newel post temporarily removed and the balusters have a square profile. A V-groove plank wall encloses the area below the staircase to form an enclosed basement stairwell.

The floor plan of each residence's second floor is the same as that of the first, with bed chambers conforming to the locations of the living areas below. There is no entry vestibule, however. Instead, the stair hall connects directly to the foyer between the residence and the light tower via a doorway at the hall's south end. Ceiling, wall, and floor finishes are the same as the first floor. The trim, where not temporarily removed, is also the same. The northern bed chamber has knee walls surmounted by inward-sloping ceilings conforming to the one-and-one-half story gable configuration of the exterior. Where bed chamber walls intersect with the exterior roof slopes, the sloping ceilings are framed with heavy sawn rafters (formerly covered with plaster and lathe) that rest atop a rafter plate capping the brick exterior walls and are braced with heavy timber purlins at the roof slope-ceiling transition to hold the attic floors. Windows and doors on these walls are crowned with deep, inward-sloping hoods and flanked by

distinctive exposed angled knee braces that extend from the floor to the purlins. These structural elements are treated as decorative features and are chamfered and topped with heavy scroll-sawn brackets at the ceiling where they intersect with the purlins. A straight flight of plank stairs enclosed in a stairwell by a V-groove plank partition rises to the finished attic.

At the top of the attic stairs is a narrow longitudinally-oriented hall dominated by two large chamfered posts with knee braces. The attic corridor is partitioned from a pair of bedrooms by a V-groove plank partition. Each rectangular bedroom is identical, but the mirror image of the other, and is dominated by the sloping ceiling under the gable, which is braced with a pair of chamfered timbers. The chamber exterior walls are plaster. Door surrounds are beaded planks, and baseboards are simple planks with a quarter-round toe.

The basement of the residence has a plank ceiling with exposed joists, brick walls, and a concrete slab floor. Brick partitions divide the basement into rooms that correlate to the first floor above and the rooms are accessed by doorways with brick segmental arch lintels. Brick piers support the chimneys and accompanying hearths. Unornamented plank stairs run between the basement and the first floor.

Light Tower

The light tower has five levels, the first two of which have floor elevations equivalent to those of the first and second floors of the residence. Deep, segmental-arch doorways lead into the light tower from the residence on these two levels. The third level of the light tower (near the level of the attic in the residence) is vacant, serving only as an intermediate level between access points below and the functional areas above. The fourth level is designated the watch level, and the fifth is the lantern gallery.

Walls of the first, second, and third levels are the exposed brick of the exterior of the tower. Walls of the fourth level are riveted sheet iron (aka boiler plate), and the lantern gallery is plate glass. The first floor's flooring is poured concrete. All upper floors are cast iron, typically bolted to rolled iron beams. Windows on the lower three levels are set in deep segmental-arch niches and have plank side frames and sills. A winding staircase bolted together from cast iron components makes quarter-turns between each floor level and terminates at semi-circular and circular landings on the second, third, and watch levels. The watch level staircase is closed off from the stairs below by a narrow, four-panel wood door. This level contains the lantern pedestal, which is a hollow cast-iron column bolted together from three segments. It is surmounted by a steel deck grate supported on curving steel knee braces (grate and braces are from 1994) that are welded to the column. The lantern gallery has cast-iron floor lights (iron panels with round glass lenses) to illuminate the watch level below. A narrow tubular steel railing surrounds the Fresnel lens (described in Part II.C below). The top of the lantern gallery is surmounted by the exposed underside of the conical metal 'dome' (the traditional term for the top of the lantern).

C. Mechanicals/Operation

The Southeast Light's light consists of a fixed, first-order, glass Fresnel lens with a 1,000 watt electric lamp. The lens is approximately 6′ in diameter with a 920 millimeter (approximately 3′) focal length. It has a field of coverage (visibility) extending in a 270-degree arc to the west, south, and east with a nominal range of 20 nautical miles (approximately 23 miles). A hemispherical metal reflector occupies the northwest side of the lens, limiting the light's visibility in this direction. The light's characteristic is

single-flashing[47] with 5 second intervals (aka eclipses) and green in color. The light's elevation (measured at the lens focal plane) is approximately 261′ above sea level, some 2-3′ higher than it was as of 1990, before the lighthouse's move. The aid-to-navigation light's overall characteristic is similar to the light's beacon as it appeared from 1929–1990, when the light flashed green at 3.45- or 3.7-second intervals and was produced by a rotating lens, rather than a blinking lamp. The lens is supposed to be nearly identical to the original *Barbier & Fenestre* light installed in the Southeast Lighthouse in 1875 when the light was first lit.[48]

The Fresnel lens was manufactured by French manufacturer by *L. Sautter Cie. (*later *L. Sautter, Lemonnier et Cie.*) for the Cape Lookout Light on the Southern Outer Banks, Carteret County, North Carolina, which was completed in 1859. The USCG removed the lens from the Cape Lookout Light in 1994 and was keeping it in storage until it was identified as an appropriate replacement for the Southeast Light lens in 1994.[49]

L. Sautter Cie. was headquartered in Paris and specialized in naval optics and electrical appliances for navigation, signaling, and other purposes. The company is named for Louis Sautter, a prominent entrepreneur and engineer in the navigation aids field. Sautter attended engineering school at the Central School of Arts and Manufactures in 1846, then, with the assistance of financial backers, bought the lens manufacturing business of Theodore Létourneau in 1852. Létourneau was the third owner of the lens manufacturing concern of instrument maker François Soleil Sr., who had worked directly with Augustin Fresnel in developing his first experimental lighthouse lenses beginning in 1819. *L. Sautter Cie*. would later diversify into additional light and sound devices for lighthouses and navigational aids, including electrical generation equipment. The last iteration of the company, named *Sautter Harlé*, was absorbed into a French conglomerate in 1969. *L. Sautter Cie.* was one of two leading producers of Fresnel lenses for the U.S. Lighthouse Board in the 1850s, the other being the French company *Henry-Lepaute*.[50]

---

[47] A flashing light in which a flash is regularly repeated and the total duration of the light in each period is clearly shorter than the total duration of the darkness. USCG, *Light List Volume I, Atlantic Coast: St. Croix River, Maine to Shrewsbury River, New Jersey* (Washington, D.C.: U.S. Government Printing Office, 2015), xviii, xxiii.

[48] When relit in 1994, the beacon flashed or was intended to at a 3.7 second interval to almost duplicate the characteristic of the existing beacon's 3.7-second interval. This was changed at an unknown date to the present 5 second interval. Contos, "Traveling Light," 7; *Lighthouse Digest,* "S.E. Block Island Re-lighted" (*Lighthouse Digest* October 1994), 2; Richard Reardon, Director of Engineering, USACE Engineering Management, New England Division; written correspondence with Judith Benedict, Rhode Island Department of Environmental Management, July 31, 1991; Southeast Lighthouse Foundation, "News Release for Saturday, August 27th, 1994"; USCG, "Historic Light Station Information & Photography: Rhode Island" accessed June 26, 2015, http://www.uscg.mil/history/weblighthouses/LHRI.asp; USCG, *Light List Volume I, Atlantic Coast: St. Croix River, Maine to Shrewsbury River, New Jersey*, 7; USCG, "USCG Light List 1964" (Typewritten manuscript on file at the Southeast Lighthouse Foundation, 1964), n.p.; United States Lighthouse Society, "Operational Classical Fresnel Lenses in the U.S." Accessed June 29, 2015, https://uslhs.org/history/fresnel-lenses/classical-fresnel-lenses/fresnel-lenses-operational-list.

[49] Nolan, personal communication with John Daly, May 20, 2015

[50] Southeast Lighthouse Foundation, "News Release for Saturday, August 27th, 1994" (New Shoreham: Southeast Lighthouse Foundation, 1994); United States Lighthouse Society, "The Fresnel Lens Makers," accessed July 1, 2015, https://uslhs.org/fresnel-lens-makers.

D. Site Information:

Southeast Light occupies an approximately 10-acre, nearly rectangular lot at the southeast corner of Block Island. The northwest corner of the lot fronts Mohegan Trail, from whence access to the property is gained. The north and east sides of the parcel are bounded by private residential parcels containing late-twentieth-century vacation homes. The west side of the parcel is bounded by the RI DEM's Mohegan Bluffs reservation, which is overgrown with low shrubs and trees. To the south, the parcel terminates at the Mohegan Bluffs that rise over 150′ from the shoreline of Atlantic Ocean at Lighthouse Cove. The Southeast Light has unobstructed views of the ocean to the south and Rhode Island Sound, to the east. The lighthouse's landward setting is characteristic of the vernacular landscape of Block Island with rolling pastoral terrain of verdant fields crossed by substantial networks of dry-laid stone walls and interspersed with farmstead clusters small ponds. Modern intrusions on this landscape come in the form of newer vacation homes, as well as the numerous stands of woody shrubs and trees that have reclaimed some nineteenth-century farm fields.

The Mohegan Bluffs have a distinct multi-hued aspect resulting from the episodic glaciation and deposition that formed them. Lower (older) levels of the bluff have gray brown color, while deposits forming the upper faces of the bluff are more of a tan to yellow-brown color. The bluffs also have a distinctive profile owing to the differential erosion rates of the upper and lower deposits. The more erosion-resistant lower levels form a headland that projects seaward and erodes into steep gullies and pinnacles. The upper deposits weather more rapidly in vertical spalls that sometimes occur in mass wasting events that carry away large blocks of sediment over 40′ deep.[51]

The Southeast Light parcel is divided into an open, approximately 6.5-acre westerly half and an overgrown, approximately 3.5-acre, eastern portion. The west, north, and east lot lines are demarked by dry-stacked field stone walls characteristic of the island. A chain link fence runs along the Mohegan Trail frontage and a plank fence runs along the south end of the lot to keep visitors from the edge of the bluffs. The buildings and structures of the former USCG complex are dispersed informally across the parcel based on functional and topographical considerations. The eastern portion of the lot slopes steeply to the east, contains an approximately 0.1-acre pond, and is covered with thick brush. Historical photos show that much of this area was once cleared. The westerly portion of the lot, which undulates gently and is covered with lawn, contains the lighthouse (near the approximate center of the parcel) and other buildings and structures. A Coast Guard Housing residence (built 1962) is located about 30′ west of the lighthouse in the open lawn. This is a 1-story brick ranch house with attached garage and currently houses Southeast Light Foundation personnel. The Garage (built 1939) located about 120′ southeast of the lighthouse is a two-by three-bay rectangular brick building with an end-gable configuration. About 30′ south of the garage is the Fog Signal. This small structure is mounted on a concrete pad facing south towards the water. It is backed by a concrete and metal sound deflection panel. Miscellaneous landscape features include a radio mast off the southeast corner of the Coast Guard Housing residence, a wood flagpole on the lawn near the fence line, and the foundation pad of the former Fog Signal Building near the edge of the bluff at the southeast corner of the parcel. A large boulder near the bluff fence line marks the approximate center point of the location of the lighthouse tower before it was moved. A dirt and gravel driveway commences at Mohegan Trail and runs on a gentle sinuous alignment southeast to the

[51] Sirkin, *Geotechnical Report: Block Island Southeast Lighthouse Property*, 1-3.

lighthouse and to a small parking lot, then continues southeast between the lighthouse and residence to the 1939 garage.[52]

Part III. Sources of Information

A. Primary Sources:

Engineering Plans

USCG Civil Engineering, *U.S.C.G. Light Station, Block Island S.E. Soil Erosion Chart*. Boston, USCG Civil Engineering, September 12, 1986. Annotated with new fence location October 1, 1987.

Grants

Block Island Historical Society. "Grant Application—National Trust for Historic Preservation's Antoinette F. Downing Preservation Services Fund for Rhode Island." New Shoreham: Block Island Historical Society, awarded March 1985.

National Park Service. "Grant Agreement No. 44-00-ML-1045." Issued by the U.S. Department of the Interior, National Park Service, Washington, D.C. under the Save America's Treasures Grant Program—Public Law 106-113, June 1, 2002.

Memoranda of Agreement

U.S. Army Corps of Engineers (USACE). "Memorandum of Agreement among the United States of America, Army Corps of Engineers, Rhode Island State Historic Preservation Officer and the Advisory Council on Historic Preservation Concerning the Relocation of Southeast lighthouse, Block Island, Rhode Island." Executed July 9, 1991.

U.S. Coast Guard (USCG). "Memorandum of Agreement between the Shore Maintenance Detachment–New York, United States Coast Guard, the Rhode Island State Historic Preservation Officer, and the Advisory Council on Historic Preservation." Executed January 6, 1989.

Specifications and Solicitations

U.S. Army Corps of Engineers (USACE). "Solicitation No. DACW33-92-R-0003, Section C–Project Description, Specifications, Work Statement, Volume 2." USACE, New England Division, 1992.

Miscellaneous Documents

USCG, "USCG Light List 1964." Typewritten manuscript on file at the Southeast Lighthouse Foundation., n.p.

---

[52] USACE, "Solicitation No. DACW33-92-R-0003, Section C–Project Description, Specifications, Work Statement, Volume 2", C-4.

B. Secondary Sources:

Published Works

Abbott, J. Michael and Olga Bachilova. *State Preservation Grant Final Report: Southeast Lighthouse*. Newport: Newport Collaborative Architects, 2010.

Adams, Virginia H., Blake McDonald, Jenny Fields Scofield, and Quinn R. Stuart. *Block Island Wind Farm and Block Island Transmission System, New Shoreham Above-Ground Historic Properties Identification, National Register Eligibility Evaluation and Preliminary Effects Assessment, Charlestown, Jamestown, Little Compton, Narragansett, New Shoreham, Newport, South Kingstown, and Westerly, Rhode Island.* PAL Report No. 2628.02. Submitted to Deepwater Wind, Providence, RI, 2012.

Bicknell, Stan. "Block Island Lighthouse to be Moved to Safer Site." *Engineering News-Record* April 19, 1993: 20.

Bachand, Robert G. *Northeast Lighthouses*, Reprinted by Maritime Center Gallery, 1989.

Block Island Historical Society and Southeast Lighthouse Foundation. "Relighting Ceremony: Southeast Lighthouse, Block Island, Rhode Island & Providence Plantations." Photocopied ceremony program, 1994.

Block Island Times. "Schneider Seeks House Appropriation for Southeast Light Rescue Effort." *Block Island Times* May 5, 1990:5.

_____. "Move to Take 7 Months." *Block Island Times* February 27, 1993:1, 15.

Cassinelli, Ron "Comment Sought on Plan to Move Southeast Light." *Providence Journal–Bulletin*, July 5, 1991:2.

Chafee, John H. "Statements on Introduced Bills and Joint Resolutions." *Congressional Record* 134 (145)—October 13, 1988:1-2.

Contos, Tanya. "Traveling Light." *Block Island Times* July 16, 1994: 11.

_____. "Traveling Light." *Block Island Times* August 27, 1994:7.

_____. "Traveling Light: How Block Island's Southeast Light Was Move Back from the Bluffs" (Pamphlet reprinted from *Block Island Times Articles,* 1993–1994).

Cutner, Naomi. "The Great Lighthouse Giveaway." *Life* August 1987:36-40.

Downie, Robert M. *The Block Island History of Photography. Volume 1 – 1870-1910s*. New Shoreham: Block Island History, 2007.

Edwards, N.C. Jr. *Block Island Southeast Light: A Strategy for Preservation and Public Access.* Boston: Aids to Navigation Branch First Coast Guard District, 1990.

Everett Associates, Inc. *Historical and Architectural Resources of Block Island: A Preliminary Report*. Prepared for the Rhode Island Historical Preservation Commission, Providence, RI by Everett Associates, Inc., 1987.

Everts and Richards. *Block Island, New Shoreham.* Philadelphia: Everts and Richards, 1895.

Goldstein, Gerald S. "Lighthouses: Our Heritage on the Rocks." *Sunday Journal Magazine* March 9, 1986: 6-21.

Greenwood, Richard E. "Block Island Southeast Light." National Register of Historic Places Registration Form, 1984. On file, Rhode Island Historical Preservation and Heritage Commission.

Haley & Aldrich, Inc. *Report on Geotechnical Investigations and Foundation Design Recommendations: Proposed Southeast Light Relocation, Block Island, Rhode Island.* Cambridge: Haley & Aldrich, Inc., 1991.

Hanan, John. "Brighter Future Sought for Old Lighthouses." *Dallas Morning News*, September 11, 1994:11A.

Irving B. Haynes and Associates. *Final Project Report: Preservation and Restoration Feasibility Study, Southeast Lighthouse, Mohegan Bluffs, Block Island, RI.* Providence: Irving B. Haynes and Associates, 1989.

Keyser, Tom. "Md. Mover Shines Under Beam of R.I. Lighthouse." *Baltimore Sun*, August 26, 1993:1, 18.

Lighthouse Digest. "S.E. Block Island Re-lighted." *Lighthouse Digest*, October 1994:1-2.

Lighthouse Preservation Society. "Accomplishments," accessed June 25, 2015, http://www.lighthousepreservation.org/accomplishments.php.

Livermore, Samuel T. *A History of Block Island.* Hartford: The Case, Lockwood & Brainard Company, 1877.

_____. *Block Island*. Hartford: The Case, Lockwood & Brainard Company, 1882.

Lord, Peter. "Lighthouse Move Rolls On." *Providence Sunday Journal* July 25, 1993: C1, C8.

_____. "Southeast Lighthouse Safely Relocated." *Providence Journal* December 6, 1993: A-1–A-4.

Moe, Richard. "News Release: Statement on the Relighting of Block Island's Southeast Light." Washington, D.C.: National Trust for Historic Preservation, August 27, 1994.

Noble, Dennis and Kenneth Arbogast. "The Coast Guard along the North Atlantic Coast." *Commandant's Bulletin* (1988).

Prible, Mike E. “Case Study: Relocation of the Block Island Southeast Lighthouse” in *Historic Lighthouse Preservation Handbook* National Park Service, V-18–V-22. Washington, D.C.: National Park Service, 1997.

Providence Journal. “Chafee Moves to Preserve Block Island Lighthouse.” *Providence Journal*, February 25, 1989, Un-paginated clipping on file, Southeast Lighthouse Foundation.

Reynolds, Andrea E. "Block Island South East Light, New Shoreham, RI." National Historic Landmark Nomination Form, 1995. On file, Rhode Island Historical Preservation and Heritage Commission, Providence, RI.

Sedovic, Walter. *Condition Survey and Assessment with Recommendations: Preservation and Restoration of the Southeast Lighthouse, Block Island, Rhode Island.* Prepared by Walter Sedovic, Consulting Architect for the Maintenance and Logistic Command, Atlantic Shore Maintenance Detachment, New York; Governors Island, NY, 1988.

Sirkin, Les. *Geotechnical Report: Block Island Southeast Lighthouse Property.* Garden City: By the author, 1989.

Smith, Martha. “The Rescued Light” *The Rhode Islander Magazine*, August 21, 1994:12-14.

Southeast Lighthouse Foundation. “News Release for Saturday, August 27th, 1994.” New Shoreham: Southeast Lighthouse Foundation, 1994.

Southeast Lighthouse Foundation. *Final Project Report: Preservation and Restoration Feasibility Study.* New Shoreham: Southeast Lighthouse Foundation, 1989.

Thomas, Mary M. “Block Island Southeast Light.” HAER No. RI-27. National Park Service, U.S. Department of the Interior, 1988.

U.S. Army Corps of Engineers (USACE). “Fact Sheet: Southeast Lighthouse, Block Island, R.I.” Waltham: USACE New England Division, 1994.

U.S Coast Guard (USCG). *Lighthouses: Then and Now.* Washington, D.C.: U.S. Coast Guard, 1987.

_____. “Block Island Southeast Light Automation Ceremony.” USCG program, July 7, 1987.

_____. *Light List Volume I, Atlantic Coast: St. Croix River, Maine to Shrewsbury River, New Jersey.* Washington, D.C.: U.S. Government Printing Office, 2015.

_____. “Historic Light Station Information & Photography: Rhode Island.” Accessed June 26, 2015, http://www.uscg.mil/history/weblighthouses/LHRI.asp.

United States Congress, “Southeast Lighthouse Preservation Act of 1989” (H.R.2428 — 101st Congress, 1989).

United States Lighthouse Society. "Operational Classical Fresnel Lenses in the U.S." Accessed June 29, 2015, https://uslhs.org/history/fresnel-lenses/classical-fresnel-lenses/fresnel-lenses-operational-list.

_____. "The Fresnel Lens Makers." Accessed July 1, 2015, https://uslhs.org/fresnel-lens-makers.

van Leeuwen, Rudy J. "Report on Southeast Light, Block Island, Rhode Island." Cambridge: LeMessurier Associates, Inc., 1985.

Waller, Joseph N., Jr. and Kate Johnson. *Phase I(c) Archaeological survey, Block Island Wind Farm and Block Island Transmission System Project, Narragansett and New Shoreham, Rhode Island*. PAL Report No. 2628.02/.03. Submitted to Tetra Tech EC, Inc., Boston, MA, 2012.

Zimmerman, Sarah J., Candace Jenkins, Anne Tait, Leslie Fox, Nancy Salzman, and Lauren Bourdreau. "Lighthouses of Massachusetts – Thematic Group Nomination, MA." National Register of Historic Places Registration Form, on file, Massachusetts Historical Commission, Boston, MA, 1986.

C. Archives and Repositories

Rhode Island Historical Preservation & Heritage Commission, Providence, Rhode Island.

- File for New Shoreham: Southeast Lighthouse Project Review.

Southeast Lighthouse Foundation, New Shoreham, Rhode Island. Three administrative records boxes contain files on the following subjects:

- Coast Guard Records, ca. 1980–1990;
- Re-light, 1994;
- Lighthouse move and related planning, 1984–1994; and
- Renovations and grants.

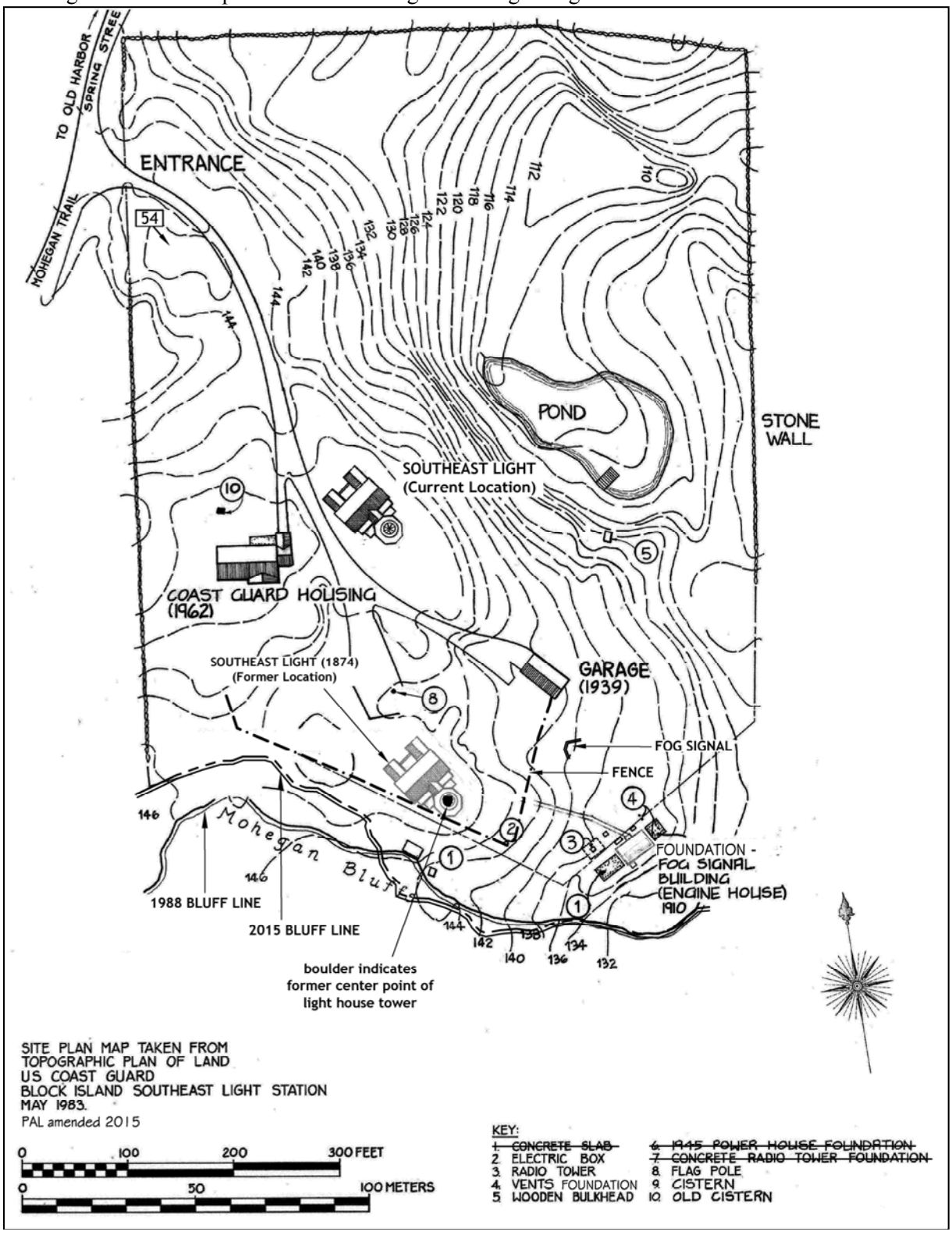
Location of the Block Island Southeast Lighthouse shown on the USGS Block Island, RI 1:24,000 1998 Quadrangle.



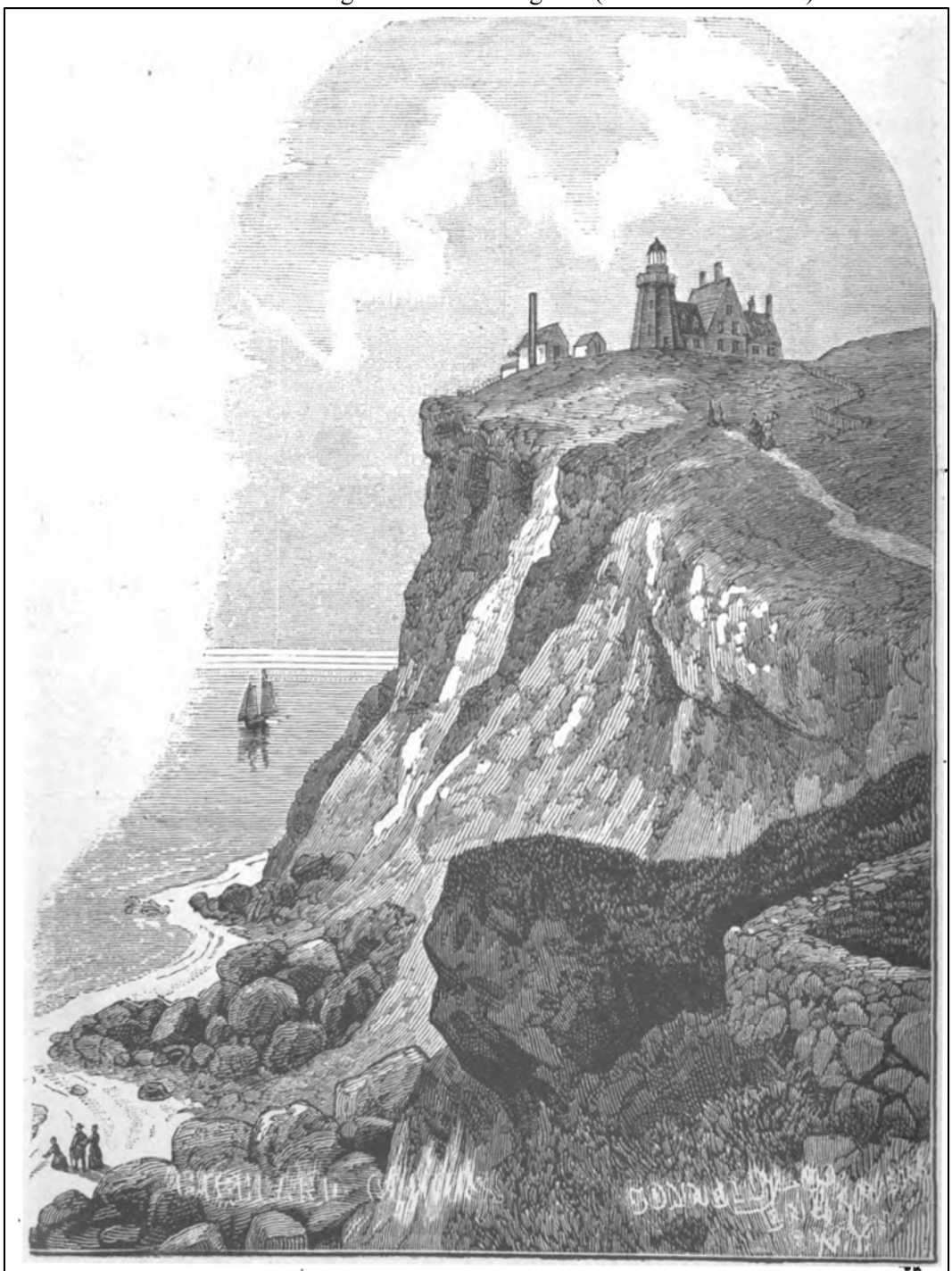
Aerial photo of Southeast Light.



Existing conditions site plan of Southeast Light showing changes to the site since 1988.

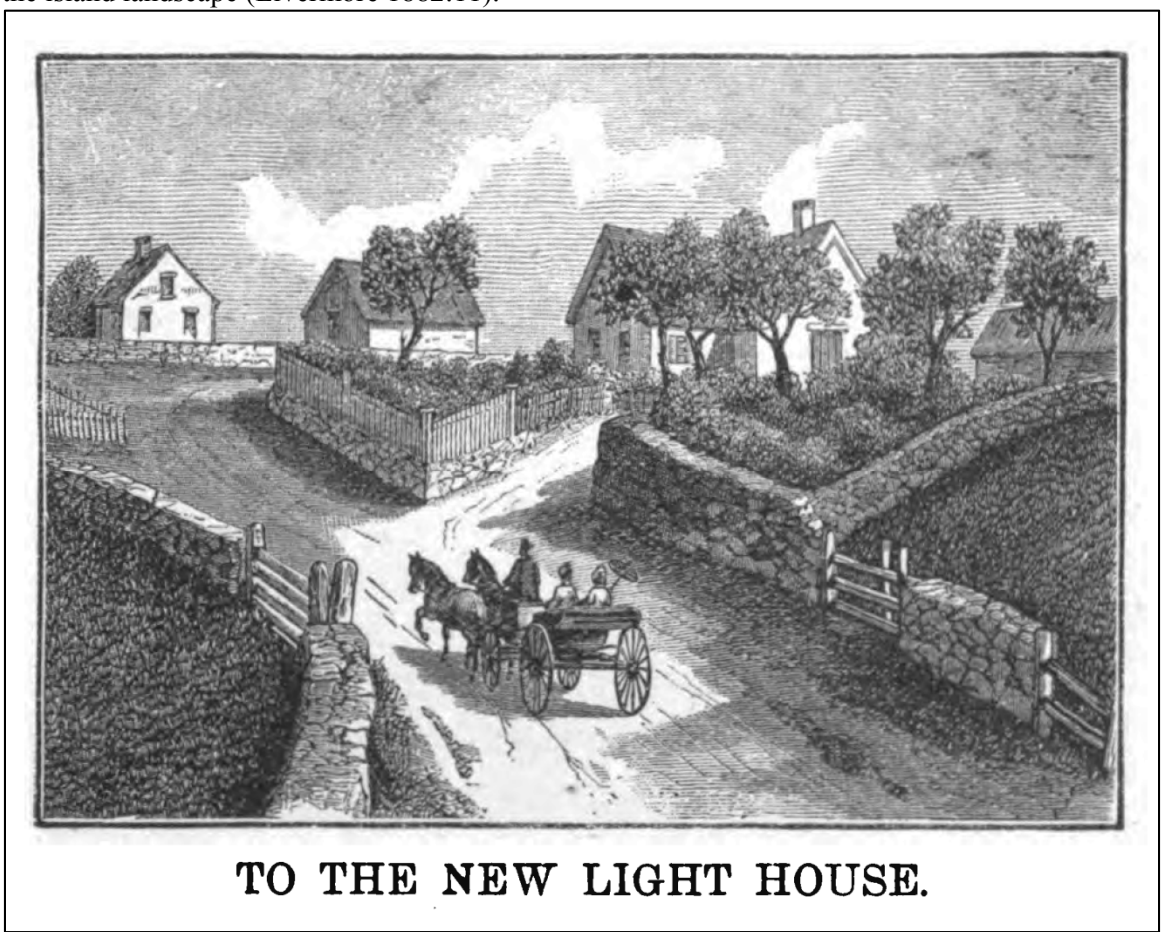


1882 illustration of Southeast Light from a tourist guide (Livermore 1881:23).



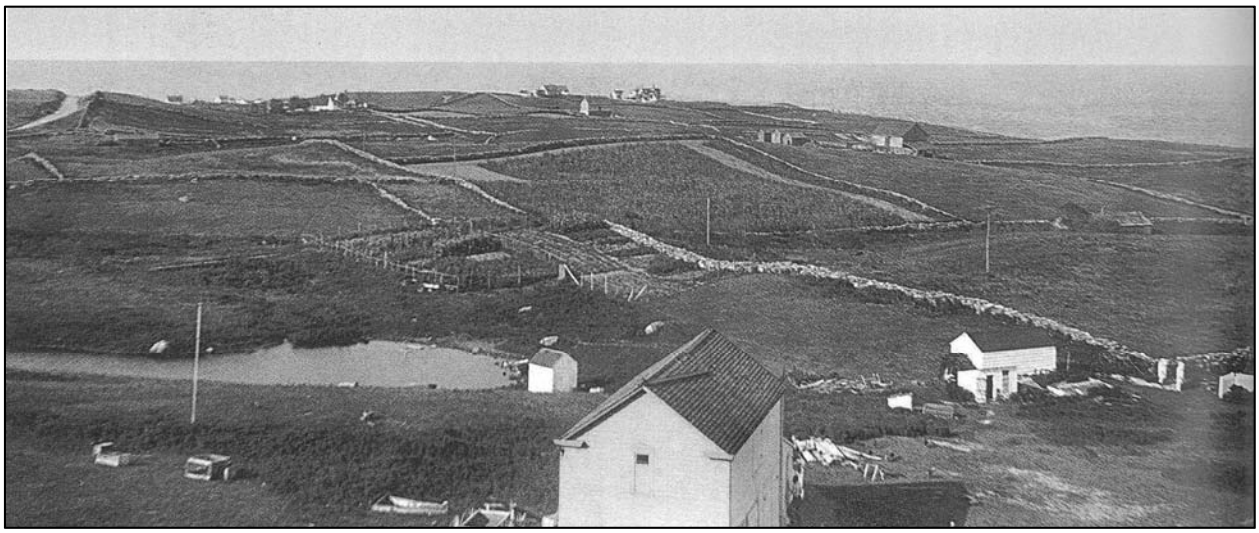
MOHEGAN BLUFFS, AND NEW LIGHT-HOUSE,
BLOCK ISLAND, R. I.

1882 illustration of a tourist party driving to Southeast Light. The drawing shows the unique character of the island landscape (Livermore 1882:11).



TO THE NEW LIGHT HOUSE.

1910 view of the landscape and seascape surrounding Southeast Light, looking northeast from the lighthouse tower (Courtesy of the Block Island Historical Society Collection).



Aerial photograph of Southeast Light in August 1992, looking north (USACE photo, on file at the Southeast Light Foundation).



1991 USACE site plan of the Southeast Light showing the proposed relocation of the building.

