FINAL

Cultural Resources Evaluation

Green Bank Observatory
Green Bank, West Virginia

Prepared for

National Science Foundation

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ch2m

Executive Summary

This Cultural Resources Evaluation has been prepared for the Green Bank Observatory (GBO), a National Science Foundation facility located near Green Bank, West Virginia. Evaluation of the property is being conducted to assess potential effects on historic built environment properties from future divestment activities or alternate operational agreements.

Several of the telescopes at GBO are notable because they are more than 50 years old and have contributed to the development of astronomical research; some telescopes may also be notable due to their engineering design. The study of potential built environment resources in the project area was undertaken in order to characterize future needs with regard to cultural resource management and the effects of any divestment alternatives. The project's Area of Potential Effects (APE) was defined as the boundary of the existing GBO property. No archaeological work was included in the scope of this project. As such, this document only addresses the built environment. The background research included a search in the National Register Information System to identify any built environment resources within the proposed APE that had already been evaluated for inclusion in the National Register of Historic Places (NRHP). The field survey encompassed standing structures built in or before 1969, which is 46 years from the present year (2015). Archival research and interviews with observatory staff were conducted at GBO. Further online research was performed in order to produce a historic context for the observatory and surrounding region. All potential built environment resources that had not been previously evaluated within the GBO boundary were surveyed and assessed, including a determination of eligibility for listing in the NRHP. Buildings and structures were evaluated individually as well as part of a potential historic district.

The background research indicated that there is one NRHP-listed structure within the APE. The field work concluded that there are four telescope instruments on the property that are individually eligible for listing in the NRHP, including the Interferometer, which includes three large telescopes. Additionally, the GBO is an NRHP-eligible historic district. There are 44 built environment resources that contribute to the NRHP-eligible historic district. Therefore, there is a potential for adverse effects to historic properties from the divestment of the GBO site.

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Acronyms and Abbreviations

APE	Area of Potential Effects
CFR	Code of Federal Regulations
GBO	Green Bank Observatory
GBT	Robert C. Byrd Green Bank Telescope
NHPA	National Historic Preservation Act
NPS	National Park Service
NSF	National Science Foundation
NRAO	National Radio Astronomy Observatory
NRHP	National Register of Historic Places
NRQZ	National Radio Quiet Zone
SETI	Search for Extra-Terrestrial Intelligence
SHPO	State Historic Preservation Officer
USNO	United States Naval Observatory

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SECTION 1

Introduction

The National Science Foundation (NSF) is an independent federal agency created by Congress in 1950 "to promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense…" (NSF, 2014). NSF is the funding source for approximately 20 percent of all federally supported basic research conducted by America's colleges and universities (NSF, 2014). NSF fulfills its mission chiefly by issuing limited-term grants (currently about 10,800 new awards per year, with an average duration of 3 years) to fund specific research proposals that have been judged the most promising by a rigorous and objective merit-review system (NSF, 2014). Most of these awards go to institutions supporting individual investigators or small groups of investigators. Others provide funding for research centers, instruments, and facilities that allow scientists, engineers, and students to work at the outermost frontiers of knowledge.

NSF also funds equipment and infrastructure that is needed by scientists and engineers, but that is often too expensive for any one group or researcher to afford; examples of such major research equipment include optical and radio telescopes. NSF's Division of Astronomical Sciences is the primary supporter of the United States' ground-based astronomy efforts.

NSF's Directorate for Mathematical and Physical Sciences, Division of Astronomical Sciences, through a series of academic community-based reviews, has identified the need to divest several facilities from its portfolio in order to retain the balance of capabilities needed to deliver the best performance on the key science of the present decade and beyond. Facilities under consideration for divestment options include several telescopes and related structures located at Green Bank Observatory (GBO) in West Virginia.

GBO is part of the National Radio Astronomy Observatory (NRAO), a federally funded research and development center. GBO's primary instrument, the Robert C. Byrd Green Bank Telescope (GBT), is used by scientists around the world to study astronomy, chemistry, physics, and radar receiving by passively detecting radio waves.

GBO is a highly visible technical asset in the state of West Virginia. West Virginia University identifies astronomy as an important area of research and depends significantly on the observing capabilities of GBT. West Virginia University committed $1 million in fiscal year 2014-2015 to support astronomical research with GBT. The Green Bank facility also has a long history of science, technology, engineering, and mathematics education, including student training and mentorships through the outreach and training opportunities offered at the NRAO Center for Science Education, which is based at the Green Bank site. In all, more than 40,000 visitors each year pass through the Green Bank Science Center, including thousands of students, educators, and the general public who stay on site to take advantage of the educational facilities. The Green Bank facility holds numerous educational workshops and programs each year aimed at middle school- through post-graduate-age training, and the site mentors on average 10-15 undergraduate and graduate students each year (O'Neil, 2014).

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SECTION 2

Proposed Project

2.1 Project Description

NSF is looking for innovative and viable divestment options for GBO. This report provides NSF with the detailed information needed to assist with decision-making regarding appropriate divestment of the facilities. In order to characterize future needs with regard to cultural resource management and the effects of any divestment alternatives on historic properties, an evaluation was conducted of historic built environment resources at GBO for use in determining their potential eligibility for listing in the National Register of Historic Places (NRHP). The evaluation included all facilities that are more than 45 years old and have not yet been assessed for eligibility.

2.2 Area of Potential Effects

The Area of Potential Effects (APE) for this project is defined as the property boundary of GBO (Figure 2-1). The total geographic area of the observatory was determined as the APE to encompass all buildings and structures on the property that are 45 years old or older (at the time of this report) in order to determine if the GBO constituted a potential historic district that could be affected by the activities associated with the potential divestment of the site.

2.3 Property Setting

GBO is located on approximately 2,200 acres in Pocahontas County, West Virginia on federal land adjacent to the Monongahela National Forest. This land is owned by NSF and includes multiple parcels that were acquired by the U.S. Army Corps of Engineers in the 1950s, when GBO was formed as the first (and then, only) site of the National Radio Astronomy Observatory. GBO is located in the National Radio Quiet Zone, where all radio transmissions are limited. Having telescopes within the Radio Quiet Zone allows for the detection of faint scientific signals that otherwise would be drowned-out by man-made signals.

Pocahontas County has a population of approximately 9,000; the total population of Green Bank is 143, but a few hundred to several thousand more people live nearby in unincorporated areas, such as Arbovale. With approximately 120 people employed at NRAO-Green Bank, GBO is a significant employer and driver of the local economy, both through the local employees and a significant program of tourism and education. Approximately 40,000 visitors per year are served by the Green Bank Science Center, located on the grounds of GBO.

Green Bank is the anchor and administrative site of the 13,000-square-mile National Radio Quiet Zone (NRQZ). The Sugar Grove Research Facility of the Department of Defense is also located within the NRQZ; GBO personnel administer the NRQZ on behalf of Sugar Grove. In addition, there are individuals seeking to avoid health effects that they perceive from electromagnetic radiation who have chosen to live in the NRQZ as a “safe haven” from that radiation.

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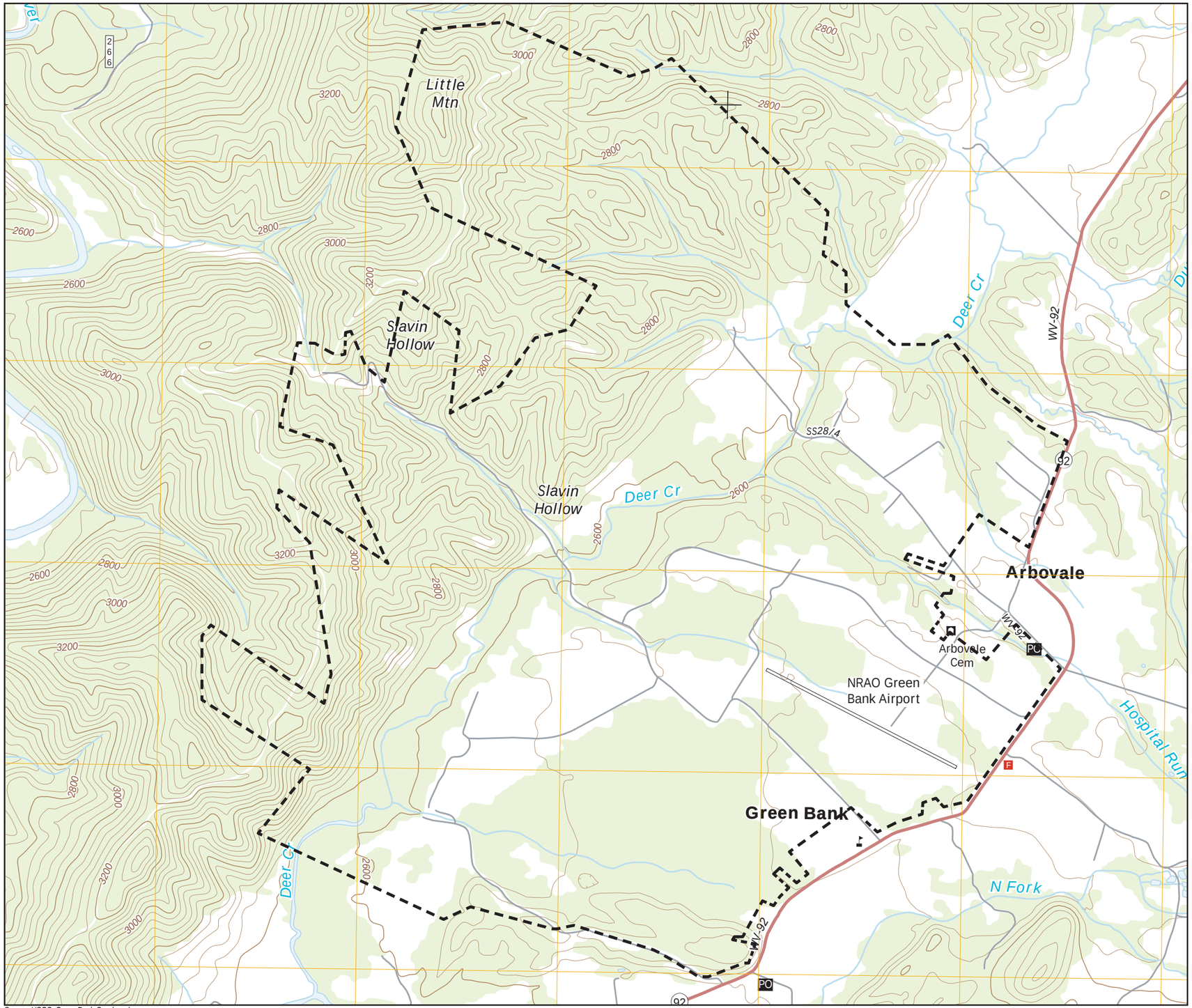

LEGEND

Area of Potential Effects (APE)

North

0 1,700

Approximate scale in feet

FIGURE 2-1
Area of Potential Effects (APE)
Green Bank Observatory
Green Bank, West Virginia

Source: USGS, Green Bank Quadrangle

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SECTION 3

Research and Field Methodology

MaryNell Nolan-Wheatley, a Secretary of the Interior-qualified architectural historian with CH2M HILL, checked the federal historic properties database in October 2014. A search in the NRHP online database, known as the National Register Information System, showed that the Reber Radio Telescope is the only structure or building located within GBO that is listed in the NRHP.

Field investigations were conducted at GBO October 6-9, 2014. The site visit to GBO was also used to engage GBO staff in informal interviews and to conduct archival research, including the review of historic photographs and narratives, newspaper articles, construction records, and architectural drawings.

Using aerial photographs of GBO and information provided by GBO staff, 47 built environment resources that had been constructed in or before 1969 were identified as extant within the APE. These include: Five telescope structures (one of which contains three large telescopes), 2 horn instruments, 1 antenna, 1 airstrip, 1 water tower, 1 recreation area, 24 residential buildings, and 12 operational and administrative buildings. As noted above, one of these telescopes, the Reber Radio Telescope, was previously evaluated; the Reber Radio Telescope was listed in the NRHP in 1972 and designated a National Historic Landmark in 1986. The remaining 46 built environment resources in the APE built in or before 1969 were photographed and evaluated for NRHP eligibility. The year 1969 was chosen as it is 45 years from the year of the site visit (2014). The standard NRHP age threshold is 50 years; however, using 45 years as the cutoff allows a 5-year buffer for the execution of the Divestment Options Study. Data collected through the background research and field investigations were analyzed to determined NRHP eligibility of the 46 surveyed built environment resources individually. In addition, the GBT, which was constructed after 1969, was evaluated individually due to the exceptional importance to radio astronomy over the last 50 years. All 47 historic-era properties (constructed in or before 1969, including the Reber Radio Telescope) and the GBT were also evaluated as a potential historic district. Properties surveyed in 2014 are listed in Attachment A. The results of the survey are presented in Section 5 and Figure 5-1 shows the locations of all previously evaluated and surveyed built environment resources.

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SECTION 4

Historic Context

4.1 West Virginia and Pocahontas County

The first European Americans to settle west of the Allegheny Mountains, in what would become Pocahontas County, West Virginia, were Jacob Marlin and Stephen Sewell. The two settlers were living in what is today Marlinton, West Virginia, when Andrew Lewis, a surveyor hired by the Greenbrier Company, arrived in 1751 to conduct a land grant survey. According to legend, Sewell was living in a hollow sycamore tree when Lewis arrived. The early Euro American settlers in the area were met with significant opposition from the native population who had historically used the region for hunting. Numerous violent encounters ensued as Euro Americans continued to intrude into Native American territory well into the nineteenth century (Pocahontas County, 2013).

Originally, West Virginia was part of Virginia. During the Civil War, the eastern section of the state, which relied more heavily on a slave-based economy, seceded with the Confederacy while 50 counties in the northwestern part of the state, including Pocahontas County, joined the Union and were subsequently granted statehood in 1863 as West Virginia (Pocahontas County, 2013). The arrival of the railroad at the turn of the twentieth century allowed for a booming commercial timber and coal industry in West Virginia. Small railroad towns emerged throughout the region. Today, Pocahontas County is known for its natural beauty; the "Land is rich, forests are thick, and waters are abundant and clean" (Pocahontas County, 2013).

4.2 The Origins of Radio Astronomy (Karl G. Jansky and Grote Reber)

Until the twentieth century, astronomers were limited to what they could see or photograph in the visible spectrum of light – a relatively narrow band of wavelengths. This all changed in 1932, when Karl Jansky, a radio engineer at Bell Laboratories in Holmdel, New Jersey, was the first to establish that radiation at radio wavelengths was reaching the earth from interstellar space (Butowsky, 1989).

Karl G. Jansky started working for Bell Laboratories in New Jersey in 1928. While there, he became interested in static and other types of noise interference that were detectable in the Bell System transoceanic radio-telephone circuits. In order to explore his interest in static radio noise, Jansky constructed a rotating, 14.6-meter directional antenna system. Research he conducted using his antenna allowed him to detect three distinct categories of noise: Noise from local thunderstorms, noise from faraway thunderstorms, and a "steady hiss of static, the origin of which was unknown" (Butowsky, 1989). This mysterious third category of noise, the derivation of which was neither earth nor the solar system, spurred Jansky to continue his research in 1932. Jansky noted that changes in the hissing noise occurred every 23 hours and 56 minutes rather than every 24 hours. This time interval marks one rotation of the earth, or one day, when measured by the location of the stars instead of the sun. Jansky deduced from this information that the noise traveled from beyond our solar system, and instead originated in the center of the Milky Way galaxy. With this finding, Jansky had discovered "the existence of interstellar radio waves… [and] liberated astronomers from the confines of optical astronomy" (Butowsky, 1989). Despite the importance of Jansky's research, his discovery did not garner much initial interest from the science community.

Grote Reber was born in Chicago, Illinois in 1911. Electronics piqued Reber's interest throughout his childhood and when he was 16, he was awarded an amateur radio license that was signed by Secretary of the Interior Herbert Hoover. He studied electrical engineering and graduated in 1933 from the Illinois Institute of Technology, formerly known as the Armour Institute of Technology (Kellermann, 2002). Post-graduation, Reber worked at several Chicago-based companies, such as Stewart-Warner and Belmont Radio Corporation. Reber read about Jansky's discovery of interstellar radio waves in 1933 and set to work trying to further Jansky's research. Reber approached other astronomers to aid in his endeavor, but received little encouragement. However, Reber was undeterred. Later, when discussing this pivotal moment in his career, Reber stated: "In my estimation it was obvious that Jansky had made a fundamental and very important discovery. Furthermore, he had exploited it to the limit of his equipment facilities. If great progress were to be made it would be necessary to construct new and different equipment especially designed to measure the cosmic static" (Butowsky, 1989).

To continue Jansky's studies, Reber needed a new type of technology: a radio telescope. With no financial support from other astronomers or research institutions, Reber was left to construct this new equipment on his own. In preparation, he enrolled in several astronomy courses at the University of Chicago and took a hiatus from his job during the summer of 1937. He constructed the telescope himself by hand in his backyard in Wheaton, Illinois, the town where he had grown up. Four months and $4,000 later, Reber had constructed the first radio telescope for radio astronomical observations (Butowsky, 1989).

For 10 years after the completion of his telescope, Reber "worked practically alone in the field of radio astronomy" (Butowsky, 1989). His research established that Jansky's deductions were accurate and that the Milky Way indeed emits radio radiation. Reber published his findings and the first contour maps that showed the radio brightness of the Milky Way in the *Astrophysical Journal* in 1944. The telescope remained in use by Reber until 1948, when the National Bureau of Standards relocated the structure to a site in Sterling, Virginia and mounted it on a turntable. The telescope was moved again in 1952 to an observatory in Boulder, Colorado before it was purchased in 1957 by the NRAO and re-erected in Green Bank between 1959 and 1960. Reber oversaw the re-assembly of the historic structure in Green Bank. The Reber Radio Telescope was listed in the NRHP under Criteria A and C in 1972 and in 1989 it was designated a National Historic Landmark. The telescope's nomination form for designation as a National Historic Landmark states that the Reber Radio Telescope "demonstrated the importance of Jansky's discovery, and forever changed the science of astronomy" (Butowsky, 1989). An exact replica of the Jansky antenna (the Karl Guthe Jansky Replica Antenna) that was made in 1964 is also currently located in Green Bank, very near to the Reber Radio Telescope.

In addition to the Karl Guthe Jansky Replica Antenna and the Reber Radio Telescope, the GBO is also home to the Ewen-Purcell horn. The significantly smaller structure was the instrument used by Harold I. Ewen and Edward M. Purcell at the Lyman Laboratory of Physics at Harvard University to discovery free hydrogen gas in the Milky Way at a wavelength of 21 centimeters (in situ plaque). The structure was constructed in 1957 and relocated to GBO in 1963 (Lockman et al., 2007).

4.3 National Radio Astronomy Observatory

The radio receiver technology that became available during World War II was more complex and stable than any previous equipment used by Jansky or Reber. After the war, furthering the field of radio astronomy became an important scientific mission for countries around the world. The United States, however, lagged behind other nations, many of which had quickly established competitive radio astronomy programs. During an international radio astronomy conference that occurred in Washington, D.C. in January 1954, participants debated ways to spur progress in radio astronomy within the United States. Although universities and other research institutions were keen to participate in radio astronomy studies, the associated tools and equipment were often prohibitively expensive. Out of discussions

regarding this financial quagmire, the idea for the NRAO was formed, "The suggestion was made that a National Radio Astronomy Observatory [NRAO] be established, equipped with the expensive research tools not obtainable by other institutions, which would be available to all qualified scientists" (NSF, 1959). By May of that same year, the NSF agreed to fund a study done by the Associated Universities, Inc. on the feasibility of establishing the NRAO.

The feasibility study resulted in a report produced in 1956 entitled "Plan for a Radio Astronomy Observatory" in which various topics were discussed, including potential sites for the observatory, types of required equipment, and organizational and operational plans. As a result of the study, "The National Science Board decided that special Federal support of radio astronomy was required and that part of this support would be in the form of a national observatory" (NSF, 1959). The Associated Universities, Inc., which was contracted by the NSF, moved forward with the construction of the NRAO on November 17, 1956 (NSF, 1959). Also in 1956, the West Virginia Radio Astronomy Zone was established by state legislation that was the "first legislation in the world intended specifically to protect basic research" (Bouton, 2013). This was just 2 years before the Federal Communications Commission established the 13,000-square-mile NRQZ, which overlapped with the West Virginia Radio Astronomy Zone, in order to protect the radio receiving facilities in Green Bank and in Sugar Grove on a federal level (Bouton, 2013).

4.4 Green Bank Observatory: Origins and Development (NRHP-Eligible Historic District Facilities)

The sensitive nature of radio telescopes limits the number of potential locations to establish an observatory. Man-made radio noise from earth can interfere with signals from space, making it difficult to distinguish between various types of data collected. Additionally, severe weather can interfere with the functionality of radio telescopes. Geographic barriers, such as mountains, help isolate radio signals from space, making valleys an ideal location for the placement of radio telescopes. Green Bank in the Deer Creek Valley had several other appealing characteristics, in addition to its geographic location encircled by mountains, such as its rural surroundings, small population, and mild climate. A book produced by the NSF in 1959 titled *The National Radio Astronomy Observatory*, which provides a historical narrative of the early years of the NRAO site, states: "The large site was selected so that a number of telescopes could be installed and operated without mutual interference" (NSF, 1959). The decision to locate the observatory in Green Bank brought a great sense of pride to the region. A special dispatch in the *Pocahontas Times* dated July 26, 1956 is titled "Green Bank Assured of Great Astronomy Center: And How Truly Thankful We All Are!" and states that "West Virginia will become the world centre of research in radio-astronomy; when the National Science Foundation [NSF] constructs its new 'window to the Universe' at the site Green Bank" (*Pocahontas Times*, 1956).

The land for the "window to the Universe" was purchased by the U.S. Army Corps of Engineers on behalf of the NSF (NSF, 1959). Most of the land was purchased from families that had multi-generational farms established in the mid- to late-nineteenth century. The earliest pioneer in the area was Adam Arbogast who had settled most of the NRAO land in 1796 (Lockman et al., 2007). A field office was established in May 1957 and construction on an access road soon proceeded. On October 17, 1957, groundbreaking ceremonies were held and one year later, on October 16, 1958, the site's first telescope, the 85-foot Howard E. Tatel Telescope, was dedicated. The rotating Howard E. Tatel Telescope was erected on a polar mount by the Radio Construction Corporation under sub-contract with the Blaw-Knox Company (NSF, 1959; Lockman et al., 2007). The telescope's control building was constructed at the same time. Dr. Frank Drake used the Tatel Telescope to search for extra-terrestrial intelligence and subsequently, the "Tatel became famous in 1960 for performing the world's first SETI (Search for Extra-Terrestrial Intelligence) observations (Project Ozma)" (Stoke, 2014).

Following the dedication of the Tatel Telescope in 1958, construction on several buildings and structures on the site was initiated, including the 43-meter Telescope (also referred to as the 140-foot Telescope), the Calibration Horn, the Karl G. Jansky Laboratory, the residence hall, the works area building, the airstrip, and the renovations of pre-existing farm houses. The 43-meter Telescope was designed by Ned L. Ashton and the E.W. Bliss Company was the prime contractor. The drive and control system of the 210-foot-tall concrete telescope was constructed by the Electric Boat Division of General Dynamics Corporation. The telescope was described as "a steerable parabaloid more than one-third of an acre in area, capable of being pointed with a precision of a small fraction of a minute of arc" (NSF, 1959). The telescope operates through a hydraulic power system and the structure rotates on a massive, 17.5-foot diameter, steel ball-bearing that was designed by Stone and Webster. General Steel Industries poured the steel for the ball-bearing (Lockman et al., 2007). Although the foundation for the 43-meter Telescope was poured in 1958, the last surface panel was not secured on the dish until 1964 and dedication occurred in 1965. With its smooth, curving concrete exterior walls and tubular shaft, the structure has a ship-like, vaguely Streamline Moderne appearance. The construction of the telescope was an engineering feat with its massive parts fabricated off site and brought to rural Green Bank by truck for assembly. According to GBO staff, bridges over creeks and rivers in the area were reinforced to allow for the arrival of these massive parts. An elevated service tower that operates on tracks was constructed adjacent to the structure for maintenance purposes in 1970. Today, the telescope stands as both an engineering and scientific achievement – the "largest [telescope] in the world of any kind to use an equatorial (for polar-aligned) mount, so that it can follow objects in the sky by rotating on one axis, rather than a minute series of up-down, left-right movements, which is much easier to build" (Stoke, 2014).

The Calibration Horn, designed by Dr. John Findlay and known as "Little Big Horn," was also constructed in this early phase of site development by the Plant Maintenance Division (Lockman et al., 2007). Positioned at a 30-degree angle, the NSF historical narrative of the NRAO published in 1959 describes it as "a radio telescope of somewhat unusual design. It is technically known as a horn antenna…[that] is fixed in such a position that it can observe the strong radio source in Cassiopeia once each day, and will be used to measure accurately the energy of the incoming radio waves" (NSF, 1959). In this way, the horn's measurements were used for comparative purposes, to calibrate and standardize the other telescopes.

The Jansky Laboratory, completed in 1959, provided 5,000 square feet of electronic laboratory space. Scientists working in the Jansky Laboratory Building had access to electronic test and repair equipment; office, conference, and seminar rooms; and technical and computing assistance, "both human and mechanical" (NSF, 1959). A large addition was added to the laboratory in 1994-1996, although the original building is still visible and retains much of its original fabric. The works area building was also completed between 1958 and 1959, with an adjacent 100,000-gallon, elevated water tank (Bouton, 2013). The original drawings for the building were completed by Irving Bowman and Associates. Soon after the building was occupied in 1959, alterations were made in 1963 including the removal of two windows, replacement of other windows, and the addition of a concrete apron (Tippetts et al., 1963). The building has historically functioned as a machine shop, auto shop, and general maintenance facility.

The residence hall, completed in 1959, included a cafeteria, 16 dormitory rooms, a lounge, and four apartments. When the NRAO property was purchased in 1957, seven residential homes, including the Nut Bin, Hannah House, Beard House, Shinnaberry House, Tracy House, Hill House, and Riley House were located within the property boundary. Most of these had been constructed in the early twentieth century, with the exception of Hill House, which was constructed circa 1896. These properties were renovated and turned into residences for the onsite staff. The 1959 history of the NRAO notes that the renovated houses "are available to visiting scientists, and also newly arrived staff members until such time as permanent housing can be found in the neighboring communities" (NSF, 1959). The Nut Bin was used for administrative purposes and as an electronics lab from 1958 to 1960. Originally constructed in

1901-1902 by Irbe Beard, a descendent of early settlers in the area, the Nut Bin was moved to its current location south of the Presbyterian Church on Route 92 in 1969, at which point it also became a staff residence (Lockman et al., 2007). An addition was constructed on to Beard House and was used briefly in the 1960s as an experiment station, although currently the building is vacant.

Construction on the NRAO site continued during the early 1960s. The 300-foot telescope and its associated control building (now called the Laser Lab), which was shielded by steel mesh so as to not interfere with the massive instrument, were constructed in 1961-1962 (Ralston, 1961). In 1971, a 1,000-square foot addition to the control building was constructed. In 1988, the 300-foot telescope collapsed, crushing part of the control building. Although the telescope was completely destroyed, the control building was repaired and its use was changed to the Laser Lab for the range finder. In 1962, more telescopes, administration facilities, and residential buildings were added to the site. The 40-foot Telescope was constructed in 1962 and was the first fully automated radio telescope in the world (Lockman et al., 2007). The bermed, underground control room was constructed at the same time, along with several small pump houses, and the Radio Frequency Interference trailer. The warehouse (now used as a daycare facility) adjacent to the works area building, was constructed in 1963 (Hahn, 1963).

Two more 85-foot telescopes (85'-2 and 85'-3) were constructed in 1963-1964 and 1965-1968, respectively. Together with the original 85-foot telescope (hereafter referred to as 85'-1), the three structures formed the Interferometer: "Beginning in the late 1960s these [three] telescopes operated in unison as one single instrument serving to prove that the technique called 'interferometry' could be used to combine dishes to form immense telescopes" (Stoke, 2014). The 85'-2 and 85'-3 telescopes were identical to the 85'-1 telescope, except that they were on wheels. This design feature allowed the two structures to move along a linear axis. The Interferometer control building was constructed in 1967-1968 (HDMK, 1966). From the late 1960s, the Interferometer allowed NRAO scientists to perform aperture synthesis observations until 1978 when management of its operation was reassigned to the United States Naval Observatory (USNO). The three-telescope instrument's new task was to monitor the earth's rotation and polar motion (Bouton, 2013). The USNO used the equipment for this task until 1987, at which point the 85'-1 and 85'2 telescopes were used to monitor extragalactic and galactic variable sources. The Interferometer was shut down in 1996 for a few months, before a cooperative agreement was established between several institutions, including the NRAO and USNO, to observe galactic variable sources. In 2000, the Interferometer Range was closed (Bouton, 2013).

Construction of a collection of new houses was initiated in 1962 and completed by 1963. Seventeen of these remain extant. Of the existing residential buildings constructed circa 1962, 13 are nearly identical ranch houses with only slight variations in cladding or floor plan. The remaining four are nearly identical two-story, Colonial Revival houses that employ similar materials and design elements as the neighboring ranch houses. These ranch and Colonial Revival houses are mainly concentrated along the northeastern boundary of the NRAO site. The ranch style Redwood House (House #1) is located near the entrance to the NRAO site and historically served as the director's house. The house was added on to in 1975 and remodeled in 1977. Ten houses (Houses #2-11) are located in an area known as the Rabbit Patch just off of Route 92. The remaining houses (Houses # 14, 16, 19, 21, 23, and 24) are located on Hannah Run Road. Drawings for some of the houses were located in the Green Bank Archives and are signed by P. Hahn.

A recreation area was also constructed in the early 1960s and eventually included a basketball court (1963), swimming pool (circa 1964), picnic area (1964), shooting range (circa 1963), golf driving range, and small ski slope with ski lift (the driving range and ski slope with lift have since been removed). The recreation area was designed as a draw for scientists and their spouses and children. Family photos taken between 1960 and 1964 by scientist Bertil Hoglund and archived at GBO depict daily life for his wife and children at the NRAO site in Green Bank during the early years of the site's operation. According to the photos, it appears the Hoglund Family spent some time living in the Riley House and

participated in many jovial occasions in the recreation area, enjoying picnics, three-legged races for the children, and athletic competitions for the adults.

As described above, the 300-foot telescope collapsed in 1988. The Green Bank Telescope, later named as the Robert C. Byrd Green Bank Telescope, was conceived to replace the 300-foot Telescope and was funded via an appropriation from the U.S. Congress. Construction on the GBT started in 1991. The structure was dedicated in 2000. The GBT is the largest fully-steerable single-reflector telescope in the world and was a groundbreaking innovation in the world of radio astronomy (Stoke, 2013).

4.5 Green Bank Observatory: Today

By explaining the nature of the universe around him, the study of astronomy helped to dispel man's dependence on magic and superstition, to unfetter his mind, and to direct his imagination into useful and creative channels (NSF, 1959).

Hoglund's photographs capture life in the early years of the NRAO site and illustrate the strong sense of place that was established following its construction in 1958. The observatory was a small-scale yet fully functioning community, complete with scientific equipment, administrative buildings, laboratories, residences, and recreation facilities. Today, the collection of telescopes demonstrates a comprehensive, linear history of radio astronomical observation starting with Jansky's antenna and ending with the GBT. The 1959 historical narrative of the NRAO notes that "it is anticipated that the National Radio Astronomy Observatory [NRAO], in the heart of the populous eastern states, will attract fully as many" visitors, as other well-known observatories such as Mount Wilson and Palomar Observatories have, and predicts that "as the number of visitors grows, [the public education program] will be expanded" (NSF, 1959). This vision has indeed been fulfilled. Today, the GBO's operations include scientific operation in addition to development programs, observer community programming, and publications. There are five large, functioning telescopes in use and the site hosts 40,000 visitors per year, including students, educators, and the general public who generally stay on site for more than one night to take advantage of the educational facilities. The GBO facility is host to multiple educational workshops and programs each year for middle school through post-graduate student training, and an average of 10 to 15 undergraduate and graduate students are mentored at the facility each year.

SECTION 5

Results

5.1 Previously Identified Cultural Resources

One previously evaluated built environment resource is located within the APE. The Reber Radio Telescope was listed in the NRHP in 1972 and designated a National Historic Landmark in 1986 (Table 5-1). The telescope was listed under Criteria A and B for its nationally significant association with the origins of radio astronomy and for its association with Grote Reber.

TABLE 5-1. Previously Evaluated Built Environment Properties within the APE
Cultural Resources Evaluation, GBO, West Virginia

Building/Structure Name	Year Built	Location	Status
Reber Radio Telescope	1937	Entrance to GBO	NRHP listed 1972; National Historic Landmark 1986

5.2 Survey

To be eligible for inclusion in the NRHP, a property must meet the requirements of at least one of the four primary NRHP criteria (National Park Service, 1997). Historic properties are those:

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

b) That are associated with the lives of persons significant in our past; or

c) That embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or

d) That have yielded or may be likely to yield, information important in prehistory or history.

In addition, properties must retain enough integrity to demonstrate their significance under the criteria. The NRHP recognizes seven aspects of integrity: setting, feeling, association, location, materials, design, and workmanship. Even if a property meets the criteria, it must retain sufficient integrity to convey that significance in order to be eligible for listing in the NRHP. Generally, properties must be at least 50 years of age to be eligible for the NRHP, unless they are proven to have exceptional importance. Criterion Consideration G applies to buildings that have achieved significance within the past 50 years.

Background research determined that one historic built environment resource, the Reber Radio Telescope, is listed in the NRHP (1972) and is a National Historic Landmark (1986) (Photograph 1).

5.2.1 Individual Resource Eligibility Determinations

Within the historical context of NRAO/GBO, there are four telescope instruments that are individually eligible for listing in the NRHP: The Interferometer Range, the 40-foot Telescope, the 43-meter Telescope, and the GBT (Photographs 2-5 and Table 5-2).

Photo 1: NRHP-listed and National Historic Landmark Reber Radio Telescope, entrance of GBO.

Photos 2-5 (clockwise from top left): The Green Bank Interferometer with the 85'-2 and 85'-3 Telescopes visible; 40-foot Telescope; a section of the 2.3-acre collecting dish of the GBT; and 43-meter Telescope.

TABLE 5-2. NRHP-Eligible Built Environment Resources within the APE
Cultural Resources Evaluation, GBO, West Virginia

Resource Name	Year Constructed	Description/Significance	NRHP Eligibility Recommendation
GBO Historic District	1958-2000	Collection of administrative/operational structures, residential buildings, and radio astronomy equipment associated with the NRAO/GBO.	Eligible (Historic District); 44 contributing resources (Attachment A)
Interferometer Range: Howard E. Tatel Telescope (85'-1) and 85'-1 control building; 85'-2 Telescope; 85'-3 Telescope; and the Interferometer control building	1958-1959 1963-1964 1965-1968	The Tatel Telescope (85'-1) was the first telescope constructed by the NRAO and performed the world's first SETI observations. The Interferometer Range connected two nearly identical telescopes to the Tatel Telescope in a linear formation. The three telescopes operated in unison and proved that dishes could be combined to form very large telescopes. This information spurred the construction of the Very Large Array telescope in New Mexico in the 1970s.	Individually eligible and contributing to GBO Historic District
40-foot Telescope and control building	1962	First fully automated radio telescope in the world. Currently operates as an educational telescope for visiting students.	Individually eligible and contributing to GBO Historic District
43-meter Telescope	1958-1965	Largest telescope in the world to use an equatorial (for polar aligned) mount. Currently used as part of the Russian Radioastron project.	Individually eligible and contributing to GBO Historic District
Robert C. Byrd Green Bank Telescope (GBT)	1991-2000	Largest moving structure on land in the world; tilt and point design that can rotate a full 360 degrees; highly sensitive data collection is "unmatched" by any other telescope in the world (Stoke, 2014).	Individually eligible and contributing to GBO Historic District

The Interferometer Range (including the Tatel [85'-1] Telescope, 85'-2 Telescope, and 85'-3 Telescope), the 40-foot Telescope, and the 43-meter Telescope are all eligible under Criterion A for their important association with events that have made a significant contribution to radio astronomy. The 43-meter Telescope is also eligible under Criterion C for its design and engineering. These telescopes maintain all seven aspects of integrity, including materials, design, workmanship, feeling, association, location, and setting. The GBT is eligible under Criteria A and C, Consideration G for achieving exceptional importance within the last 50 years thanks to its remarkable design and function. The GBT is eligible under Criterion A for its important association with recent scientific developments in radio astronomy. The result of years of radio astronomy innovation at GBO, the GBT has realized unparalleled capabilities, including "unmatched sensitivity to diffuse clouds of gas and dust that feed star and galaxy formation" (Stoke, 2014). The massive instrument is able to collect data a total of 6,500 hours each year and interact with other, distant astronomy instruments to amass unprecedented amounts of information used by scientists around the world (NRAO, 2014b). A slideshow presentation prepared by the NRAO called "NRAO's Green Bank WV Site: The History of Radio Astronomy on Display" states that the GBT is "'historic' in that it represents the likely culmination of the era of enormous single dishes in radio astronomy" (Stoke, 2014). It is able to fulfill its function thanks to the structure's innovative and noteworthy design including its massive collecting dish with 2,200 aluminum panels that can rise and fall by 1 inch, its complex welded steel shaft structure, its ability to fully rotate 360 degrees, its unblocked

aperture, and its single focal plane. All of these design features combine to form a highly sensitive instrument that can retrieve data from 85 percent of the "celestial sphere" (NRAO, 2014b). Therefore, the GBT is eligible for the NRHP under Criteria A and C.

Three radio astronomy instruments and one telescope located within the boundaries of GBO are significant for their association with important events or people related to radio astronomy or for their design, but are not individually eligible for listing in the NRHP due to a lack of integrity. These include: the Calibration Horn, the Jansky Replica Antenna, the Ewen-Purcell Horn, and the 45-foot Telescope (Photographs 6-9).

Photographs 6-9 (clockwise from top left): Calibration Horn; Karl Guthe Jansky Replica Antenna; 45-foot Telescope; and Ewen-Purcell Horn. These structures have significant historic associations but are not individually NRHP-eligible.

The Calibration Horn (1958) is a significant instrument within the history of the NRAO, as it was the standard by which all other measurements at the observatory were made. However, the horn is currently unused and is heavily obscured by vegetation. As a non-functioning instrument in an overgrown condition, the horn has lost integrity of setting and feeling, and due to a lack of maintenance the structure has lost some integrity of materials and workmanship. The horn remains a significant element in the history of radio astronomy and an important educational tool for the observatory but does not retain sufficient integrity to be individually eligible for the NRHP. The Jansky Replica Antenna (1964) is an important educational tool at GBO; it represents the discovery of radio astronomy and has a significant association with Karl Jansky. However, the antenna was built at GBO as a replica for display. The structure does incorporate some parts from Jansky's original antenna, but most of the materials are not from the original 1933 instrument. Additionally, it is not located in the same site as the 1933 original, nor does it have the same setting. The replica is now more than 50 years old; however, the replica has not achieved individual significance apart from its connection to the original 1933 structure. The replica is used as an educational display to demonstrate Jansky's work in the 1930s, but it does not reveal significant information about the period when it was reconstructed (1964). Therefore, the replica antenna is not individually eligible for listing in the NRHP. The Ewen-Purcell Horn (1957) was used to make an important scientific discovery and is associated with two significant astronomers. However, the

horn was relocated to GBO from its original location in the Boston-Cambridge area. The relatively small horn is currently used as a display piece, mounted on stone piers; while it serves as an important educational tool within the GBO site, it is a piece of equipment that has lost integrity of location, feeling, and setting due to its relocation. Therefore, it does not retain sufficient integrity to be individually eligible for listing in the NRHP. Lastly, the 45-foot Telescope (circa 1965), which was relocated to GBO in 1972, was part of a pair of telescopes that functioned together as a larger Interferometer instrument. The 45-foot Telescope was separated from its pair and no longer functions as part of an Interferometer. Therefore, it lacks integrity of location, feeling, setting, and association and is not individually eligible for listing in the NRHP.

The 39 remaining surveyed buildings and structures are not individually eligible for listing in the NRHP. They include: 12 administrative/operational facilities, 1 water tower, 1 airstrip, 1 recreational area, and 24 residential buildings. The buildings and structures are not eligible for listing in the NRHP because they are not individually significant in terms of the historical development of the observatory nor the field of radio astronomy. No particular events are known to directly link the buildings and structures to any important historic events; therefore, the 39 remaining buildings and structures are not individually eligible for listing in the NRHP under Criterion A.

To be eligible for the NRHP under Criterion B, a property must be directly associated with a person considered significant within a historic context, whose specific contributions to history have been both identified and documented. There is no evidence to indicate that these 39 buildings and structures have important associations with historically significant individuals. While many important scientists used these buildings, there are other structures on the site (such as the scientific instruments) that better convey the significant work accomplished or associated with such individuals. Therefore, they are not individually eligible under Criterion B.

In terms of design, the 39 remaining surveyed buildings and structures are primarily unremarkable residential buildings or simple utilitarian structures that resemble designs for other administrative, operational, or maintenance facilities around the world (Photographs 10-11). The late-nineteenth century and early twentieth century farm houses are modest, unexceptional, wood frame residences. The residences that were constructed 1962-1963 are undistinguished, ranch style buildings that were widely replicated around the country. In addition, the majority of the buildings within GBO have been altered, including small additions and the replacement of original windows and siding. None of the administrative or residential properties embody the distinctive characteristics of a type, period, or method of construction; they do not represent the work of a master nor do they possess high artistic value. Therefore, these 39 buildings and structures are not individually eligible under Criterion C.

Due to the standard construction and design of these 39 built environment resources, the ordinariness of the materials used and their lack of a direct, significant association to important historic people or events, the properties are unlikely to individually provide further information significant to prehistory or history. Therefore, these 39 surveyed resources are not individually eligible under Criterion D, which requires that structures have yielded or may be likely to yield information important in prehistory or history.

Photos 10-11 (left to right): Typical GBO support buildings - a residential property (House #4) and the works administration building.

In summary, out of the 47 surveyed resources, four telescope instruments (one of which is composed of three telescopes) are individually eligible for listing in the NRHP for their significant association with scientific events and developments in radio astronomy or for their design. An additional four structures are considered historically significant, but do not retain sufficient integrity to convey that significance and are not individually eligible for listing in the NRHP. The 39 remaining resources are not associated with events that have made significant contributions to the broad patterns of local, regional, or national history; are not directly associated with any persons considered important in local, state, or national history; are all unremarkable or utilitarian designs that do not represent a unique style; and are not likely to yield information important in prehistory or history. In total, 43 of the 47 surveyed resources either do not meet the NRHP criteria or do not retain sufficient integrity to convey that significance and for this reason are not individually eligible for listing in the NRHP.

5.2.2 District Eligibility Determination

All of the evaluated resources are located within Green Bank in Pocahontas County and within the NRQZ. With several exceptions, including the farm houses and barns that predate the NRAO, the Reber Radio Telescope (1937), and the GBT (2000), the vast majority (34 resources) of the buildings and structures located within the GBO boundaries were constructed during the first decade of the NRAO between 1958 and 1968.

The National Park Service (NPS) Bulletin entitled *How to Complete the National Register Registration Form* defines a historic district as "possess[ing] a significant concentration, linkage, or continuity of sites, buildings, structures, or objects united historically or aesthetically by plan or physical development." The bulletin also clarifies that "a district may contain noncontiguous elements only where the historic interrelationship of a group of resources does not depend on visual continuity and physical proximity" (NPS, 1997). The built environment resources that are 45 years of age or older on GBO have significant commonalities: They were all used to further the field of radio astronomy and for the most part have functioned continuously as part of an observatory for over five decades (Photograph 12). In addition, many of the buildings employ similar materials and construction techniques. These similarities link them in a significant way and unite them both historically and in some instances, aesthetically. Although many of the resources have undergone additions and alterations to accommodate changes in radio astronomy technology, as well as other developments within the NRAO/GBO, these changes have not resulted in a significant loss of physical integrity; as a result, the buildings and structures are still able to convey their historical association and significance as a district.

Photo 12: GBO administrative area and airstrip, view from the top of the GBT.

There are 44 resources within the APE that are recommended as contributing to the proposed GBO historic district, the boundaries of which coincide with the site's property boundaries (and the APE) (Table 5-2, Figure 5-1, and Attachment A). Contributing elements include eight administrative/operational buildings, one airstrip, one water tower, one recreational area, 24 residential buildings, two horns, one antenna, and six telescopes (the Interferometer includes three large telescopes). The scientific instruments within the APE are a collection of telescopes, horns, and antenna that are significant for their role in the development of radio astronomy and in several instances as remarkable feats of engineering. Four of these historic telescopes remain in operation and retain excellent integrity of materials, workmanship, design, feeling, association, setting, and location. The Interferometer has been closed for several years and has suffered some deterioration from rust, but the three associated telescopes retain most of their physical integrity and their setting. As a whole, the majority of the components that make up the potential district's historic character possess integrity, even though many of the buildings are individually undistinguished.

Four buildings within the APE were identified as non-contributing resources. These include: three barns and one cellar building, all of which date from the early twentieth century. The four non-contributing buildings pre-date the establishment of the NRAO and have been primarily left vacant or used as miscellaneous storage facilities. No records indicate a direct involvement between these buildings and the function of the observatory, historically or presently.

The administrative and operations buildings and structures within the GBO are primarily utilitarian buildings or structures with simple designs executed using practical and standard materials, such as metal and concrete, often with brick or permastone veneer. These elements create an unassuming, though cohesive, visual unit that emphasizes their historically linked function as support for the observatory. The resources were built rapidly during the first decade of NRAO's operation often with a common plan and common design theme.

As a group, the 44 contributing built environment resources are a distinct and well-preserved representation of the early years of the NRAO, complete with scientific instruments, administration/operational facilities, recreation area, and residential buildings. Additionally, the scientific instruments present on site illustrate a linear, historical narrative of the history of radio astronomy from the Jansky Replica Antenna and Reber Radio Telescope to the monumental GBT. The resources share a distinct and significant history that is unique in both time and place. Individually, many of the resources are not representative examples of a type, period, or method of construction. However, together, the buildings and structures form a singular community and history that could never be replicated. The resources possess a significant linkage or continuity that is united historically by function, plan, and physical development.

The GBO is a collection of buildings and structures mostly built between 1958 and 1968, and most of which are still functioning, that captures the early history of radio astronomy in the United States and illustrates the subsequent development of the field. Therefore, the GBO is eligible as a historic district for representing an important time in science history and for its significant contribution to the advancement of radio astronomy.

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Building / Structure Name

Administrative / Operational

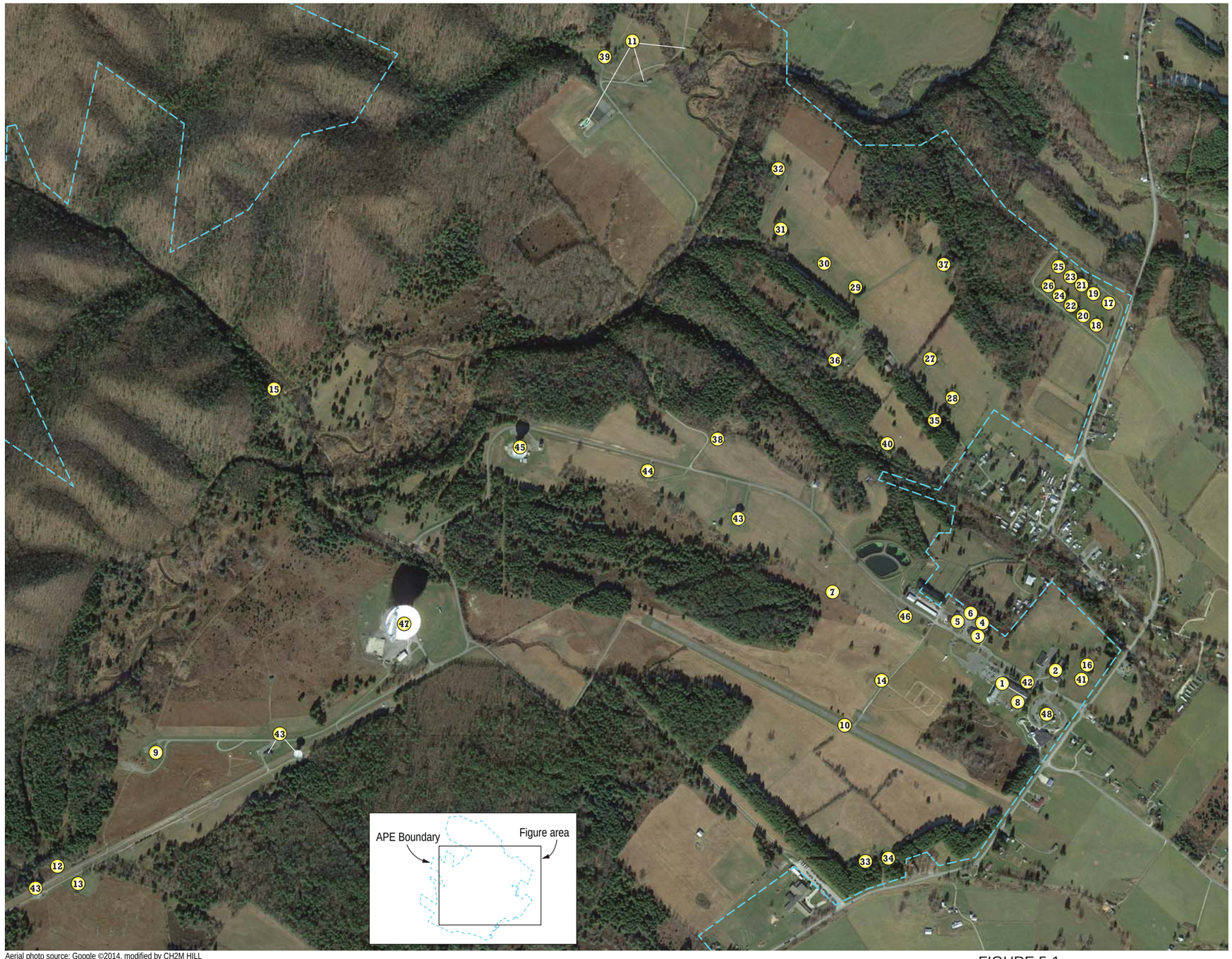
1. Karl Guthe Jansky Laboratory
2. Cafeteria Building and Residence
3. Warehouse
4. Water Tower
5. Works Area Building
6. Telescope Mechanics Office (formerly Cable Storage Warehouse)
7. Millimeter Array Experiment Building
8. Outdoor Test Building
9. Laser Lab (formerly 300' Telescope Control Building)
10. Airstrip
11. Recreation Area
12. Barn
13. Barn
14. Barn
15. Slaven Hollow Orchard Cellar Building

Residential Buildings

16. Redwood House (House #1; Director's House)
17. House #2 (Rabbit Patch)
18. House #3 (Rabbit Patch)
19. House #4 (Rabbit Patch)
20. House #5 (Rabbit Patch)
21. House #6 (Rabbit Patch)
22. House #7 (Rabbit Patch)
23. House #8 (Rabbit Patch)
24. House #9 (Rabbit Patch)
25. House #10 (Rabbit Patch)
26. House #11 (Rabbit Patch)
27. House #16
28. House #14
29. House #19
30. House #21
31. House #23
32. House #24
33. Shinnaberry House
34. Nut Bin
35. Riley House (#15)
36. Hill House (#17)
37. Tracy House (#18)
38. Beard House
39. Hannah House

Structures / Telescopes

40. Calibration Horn
41. Karl Guthe Jansky Replica Antenna
42. Ewen-Purcell Horn
43. Green Bank Interferometer: Includes Howard E. Tatel (85'-1) Telescope & 85'-1 control building; 85'-2 Telescope; 85'-3 Telescope; and the Interferometer Control Building
44. 40' Telescope & 40' Telescope Control Building
45. 140' Telescope (43m Telescope) & maintenance structure
46. 45' Telescope
47. Robert C. Byrd Green Bank Telescope (GBT)
48. Reber Radio Telescope



LEGEND

- NRHP Contributing
- NRHP Non-Contributing
- NRHP Individually Eligible
- NRHP Individually Listed
- Surveyed Property
- Area of Potential Effects (APE)

Aerial photo source: Google ©2014, modified by CH2M HILL

North

0 1,000

Approximate scale in feet

FIGURE 5-1
Built Environment Resources
Green Bank Observatory
Green Bank, West Virginia

CH2MHILL

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SECTION 6

Conclusion

There are 47 built environment resources within the APE that are 45 years of age or older at the time of this report. One of these, the Reber Radio Telescope, was previously listed in the NRHP and determined a National Historic Landmark. The remaining 46 historic-era built environment properties were surveyed for this technical report. Despite the fact that the GBT is less than 50 years old, the telescope was surveyed and evaluated due to its exceptional significance. Four telescopes were identified within the APE as individually eligible for listing in the NRHP. One of these is the Interferometer which encompasses three large telescopes. The remaining built environment properties do not meet the NRHP criteria or do not retain sufficient integrity to be individually eligible for listing. The GBO was also surveyed as a potential historic district and was found to be eligible for listing in the NRHP. Forty-four resources within the APE were identified as contributing to the historic district.

These findings indicate that there are historic properties (44 NRHP-listed, NRHP-eligible, or contributing buildings and structures and one historic district) located within the APE, and therefore, any alterations or demolitions that may occur as part of the site's divestment could result in an adverse effect on historic properties. If any activities associated with the divestment are determined to affect identified historic properties, consultation with the West Virginia Division of Culture and History (SHPO) would be required under Section 106 of the NHPA.

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SECTION 7

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Attachment A
Surveyed Built Environment Resources

Building/ Structure Name	Year Built	Description	Function	Alterations	NRHP Status	Contributing to Historic District?
ADMINISTRATIVE/ OPERATIONAL						
Karl Guthe Jansky Laboratory	1959	Steel-column frame, administration building	Supports the telescopes: electronics lab, administrative offices, astronomer's controls	Addition (1994-1996)	Not individually eligible	Yes
Cafeteria Building and Residence	1959	Concrete block, residence hall	Temporary residence and administrative functions	Addition (2003)	Not individually eligible	Yes
Warehouse	1963	Utilitarian: Flat roof, brick veneer	Currently day care facility; historically warehouse and cryogenics lab	N/A	Not individually eligible	Yes
Water Tower	1958	Steel, elevated water tank	Water storage	N/A	Not individually eligible	Yes
Works Area Building	1959	Utilitarian: Flat roof, brick and permastone veneer	Machine shop, auto shop, general maintenance	Alterations (1963); Addition (date unknown)	Not individually eligible	Yes
Telescope Mechanics Office (formerly Cable Storage Warehouse)	Circa 1960	Utilitarian: corrugated metal	Maintenance	Addition (2002)	Not individually eligible	Yes
Millimeter Array Experiment Building	1962-1963	Small, concrete block and permastone veneer	Vacant	N/A	Not individually eligible	Yes
Outdoor Test Building	Circa 1960	Utilitarian: concrete block and face brick, flat roof	Equipment building	N/A	Not individually eligible	Yes
Laser Lab (formerly 300' Telescope Control Building)	1961-1962	Concrete block and face brick, side gabled roof	Laser Lab for range finder	Addition (1971); Repairs and renovation (circa 1988)	Not individually eligible	Yes
Airstrip	1958-1960	Paved airstrip	Closed	N/A	Not individually eligible	Yes
Recreation Area	1963-1964	Picnic area, swimming pool, basketball court, shooting range	Recreation	Addition to Picnic Area (circa 1998); Shooting range buildings demolished and recently rebuilt; Ski lift and golf driving range removed.	Not individually eligible	Yes
Barn	Early twentieth century	Wood frame barn with gambrel roof	Vacant/Storage	N/A	Not individually eligible	No
Barn	Early twentieth century	Wood frame barn with gable roof	Vacant/Storage	N/A	Not individually eligible	No
Barn	Early twentieth century	Wood frame barn, concrete foundation, painted white	Vacant/Storage	N/A	Not individually eligible	No
Slaven Hollow Orchard Cellar Building	Early twentieth century	Wood frame, cellar building	Vacant	N/A	Not individually eligible	No

Building/ Structure Name	Year Built	Description	Function	Alterations	NRHP Status	Contributing to Historic District?
RESIDENTIAL BUILDINGS						
Redwood House (House #1; Director's House)	1962	Wood frame ranch house	Residential	Addition (1975); Remodel (1977)	Not individually eligible	Yes
House #2 (Rabbit Patch)	1962	Wood frame ranch house	Residential	Alterations (cladding, windows)	Not individually eligible	Yes
House #3 (Rabbit Patch)	1962	Wood frame ranch house	Residential	Alterations (windows)	Not individually eligible	Yes
House #4 (Rabbit Patch)	1962	Wood frame ranch house	Residential	Alterations (cladding, windows)	Not individually eligible	Yes
House #5 (Rabbit Patch)	1962	Wood frame ranch house	Residential	Alterations (cladding, windows)	Not individually eligible	Yes
House #6 (Rabbit Patch)	1962	Wood frame, two-story Colonial Revival house	Residential	Alterations (cladding, windows)	Not individually eligible	Yes
House #7 (Rabbit Patch)	1962	Wood frame, two-story Colonial Revival house	Residential	Alterations (windows)	Not individually eligible	Yes
House #8 (Rabbit Patch)	1962	Wood frame ranch house	Residential	Alterations (cladding, windows)	Not individually eligible	Yes
House #9 (Rabbit Patch)	1962	Wood frame ranch house	Residential	Alterations (cladding, windows)	Not individually eligible	Yes
House #10 (Rabbit Patch)	1962	Wood frame ranch house	Residential	Alterations (cladding, windows)	Not individually eligible	Yes
House #11 (Rabbit Patch)	1962	Wood frame ranch house	Residential	Alterations (cladding, windows)	Not individually eligible	Yes
House #14	1962	Wood frame ranch house	Vacant	Alterations (cladding, windows)	Not individually eligible	Yes
House #16	1962	Wood frame ranch house	Residential	Alterations (cladding, windows)	Not individually eligible	Yes
House #19	1963	Wood frame, two-story Colonial Revival house	Residential	Alterations (cladding, windows)	Not individually eligible	Yes
House #21	1963	Wood frame ranch house	Residential	Alterations (cladding, windows)	Not individually eligible	Yes
House #23	1963	Wood frame ranch house	Residential	Alterations (cladding, windows)	Not individually eligible	Yes
House #24	1963	Wood frame, two-story Colonial Revival house	Residential	Alterations (cladding, windows)	Not individually eligible	Yes
Shinnaberry House	Circa 1940	Wood frame farm house	Residential	Alterations (cladding, windows)	Not individually eligible	Yes
Nut Bin	1901-1902	Wood frame farm house with vinyl siding	Residential	Alterations (cladding, windows)	Not individually eligible	Yes
Riley House (#15)	Early twentieth century	Wood frame farm house	Residential	Alterations (cladding, windows)	Not individually eligible	Yes
Hill House (#17)	Circa 1896	Wood frame farm house	Residential	Alterations (cladding, windows)	Not individually eligible	Yes
Tracy House (#18)	Early twentieth century	Wood frame farm house	Residential	Alterations (cladding, windows)	Not individually eligible	Yes
Beard House	Early twentieth century	Wood frame farm house	Vacant (used as an experiment station in the 1960s)	Addition (circa 1960s)	Not individually eligible	Yes
Hannah House	Early twentieth century	Wood frame farm house	Residence for summer school students	Heavily altered, Renovation (2000-2003)	Not individually eligible	Yes

Building/ Structure Name	Year Built	Description	Function	Alterations	NRHP Status	Contributing to Historic District?
STRUCTURES/TELESCOPES						
Calibration Horn	1958-1959	Aluminum with welded seams horn with a concrete shed and a wood frame support structure	Display	N/A	Not individually eligible	Yes
Karl Guthe Jansky Replica Antenna	1964	Antenna replica	Display	N/A	Not individually eligible	Yes
Ewen-Purcell Horn	1957	Horn for collecting radio waves	Display	Relocated to GBO in 1963	Not individually eligible	Yes
Green Bank Interferometer: Includes Howard E. Tatel (85'-1) Telescope & 85'-1 control building; 85'-2 Telescope; 85'-3 Telescope; and the Interferometer Control Building	1958-1959 [85'-1 and control building]; 1963-1964 [85'-2]; 1965-1968 [85'-3]; 1967-1968 [Interferometer control bldg]	Telescopes	Closed	N/A	Individually eligible	Yes
40' Telescope & 40' Telescope Control Building	1962	Telescope	In operation - Education Telescope	N/A	Individually eligible	Yes
140' Telescope (43m Telescope) & maintenance structure	1958-1965/1970	Telescope	In operation	N/A	Individually eligible	Yes
45' Telescope	Circa 1965	Telescope	In operation	Moved to GBO in 1972	Not individually eligible	Yes
Robert C. Byrd Green Bank Telescope (GBT)	1991-2000	Telescope	In operation	N/A	Individually eligible	Yes