NATIONAL SCIENCE FOUNDATION
**2415 Eisenhower Avenue**
**Alexandria, Virginia 22314**

Mr. Randall Reid-Smith, State Historic Preservation Officer
West Virginia Division of Culture and History
Historic Preservation Office
1900 Kanawha Boulevard East
Charleston, West Virginia 25305

October 31, 2017

RE: Transmittal of *Proposed Changes to Green Bank Observatory Operations: Historic Properties Assessment of Effect* Technical Report, Green Bank, Pocahontas County, West Virginia

FR#: 17-49-PH-1

Dear Mr. Reid-Smith,

The National Science Foundation (NSF) initiated Section 106 consultation with the West Virginia Division of Culture and History, Historic Preservation Office (SHPO) on December 2, 2016, regarding the undertaking of Proposed Changes to Green Bank Observatory (GBO) Operations in Pocahontas County, West Virginia. On December 22, 2016, NSF received a response letter from the West Virginia SHPO that provided concurrence on the APE, defined as the property boundary for GBO. In addition, SHPO agreed that the Reber Radio Telescope (NR# 72001291) remains historically significant and concurred that there are four additional GBO telescopes that are individually eligible for the NRHP: the Interferometer Range; 40-foot Telescope; 43-meter (140-foot) Telescope; and the Robert C. Byrd Green Bank Telescope (GBT).

Also in the December 22, 2016, letter, the West Virginia SHPO noted that while it appears likely that the GBO is eligible for the NRHP as a historic district, additional documentation would be required to provide concurrence with this assessment. SHPO requested that Historic Property Inventory (HPI) forms be completed for each resource that might contribute to a potentially NRHP-eligible GBO Historic District. West Virginia HPI forms were completed for 48 architectural resources and were submitted to the SHPO on May 19, 2017, for review and concurrence. NSF determined that 44 buildings and structures contribute to the GBO Historic District. SHPO concurred with the determinations of eligibility for the GBO Historic District on June 12, 2017.

With this letter, NSF is transmitting the *Proposed Changes to Green Bank Observatory Operations: Historic Properties Assessment of Effect* technical report for review and comment (Enclosure 1). The report describes the proposed undertaking and provides an assessment of effects associated with it. In the concurrence letter dated June 12, 2017, the West Virginia SHPO stated that an assessment of

potential effects resulting from the proposed project should not be completed until NSF chose a preferred alternative for the undertaking. NSF anticipates identifying a preferred alternative in its upcoming Draft EIS. However, NSF seeks to coordinate the Section 106 and NEPA processes, as recommended by the Council on Environmental Quality and the Advisory Council on Historic Preservation. As part of this coordination, NSF has developed effects findings for all alternatives. This is needed because of the unique circumstances of this divestment effort and the wide range of alternatives under consideration; if, for example, NSF determines further along in the process that its preferred alternative is not viable, then another alternative would have to be used. To avoid costly delays and duplicative efforts to apply the criteria of adverse effect to another alternative later in the process, NSF has chosen to evaluate the effects of all the alternatives equally and simultaneously. This also helps to inform the NEPA process and selection of the preferred alternative. If the preferred alternative is ultimately not feasible, NSF would resume Section 106 consultation for the other alternatives. Ultimately, the Memorandum of Agreement or Programmatic Agreement that results from the Section 106 consultation process would likely address potential adverse effects only from the preferred alternative.

We respectfully request a response within 30 days from receipt of this letter to:

Ms. Elizabeth Pentecost
National Science Foundation
Division of Astronomical Sciences
4201 Wilson Blvd, Suite 1045
Arlington, Virginia 22230
epenteco@nsf.gov

The West Virginia SHPO previously requested that NSF forward any comments received as a result of the Section 106 consultation process to the SHPO. A spreadsheet with the public scoping meeting comments related to cultural resources, as well as Section 106 responses and comments received to date were submitted to the West Virginia SHPO on May 18, 2017. Since that time, the Delaware Nation has requested to become a consulting party on the undertaking. Their correspondence is included in Enclosure 2. We will also provide an electronic copy of this report to the consulting parties that have been identified for this undertaking (see cc list). If you have any questions, please do not hesitate to contact me by phone at 703-292-4592 or by email at cblanco@nsf.gov. We look forward to your comments and further consultation on this proposed undertaking.

Regards,

Caroline M. Blanco

Caroline M. Blanco
Federal Preservation Officer
Assistant General Counsel
National Science Foundation

**cc to consulting parties (by email):** Danielle LaPresta Parker, Preservation Alliance of West Virginia
Daryl White, citizen
Grayg Ralphsnyder, DRA Global
Kimberly Penrod, Delaware Nation
Robert Sheets, Pocahontas County Historical Landmark Commission

**Enclosures:**

1. *Proposed Changes to Green Bank Observatory Operations: Historic Properties Assessment of Effect*
2. Delaware Nation Correspondence

TECHNICAL REPORT

# Proposed Changes to Green Bank Observatory Operations: Historic Properties Assessment of Effects

*Prepared for*

National Science Foundation

August 2017

CH2M HILL Engineers, Inc.
6600 Peachtree Dunwoody Rd, 400 Embassy Row, Suite 600
Atlanta, Georgia 30328

# Contents

## Tables



## Figures

# Acronyms and Abbreviations

| | |
|---|---|
| AAAC | Astronomy and Astrophysics Advisor Committee |
| ACHP | Advisory Council on Historic Preservation |
| APE | Area of Potential Effects |
| AST | Astronomical Sciences |
| AUI | Associated Universities, Inc. |
| C.F.R. | *Code of Federal Regulations* |
| GBO | Green Bank Observatory |
| GBT | Green Bank Telescope |
| HPI | Historic Property Inventory |
| MOA | Memorandum of Agreement |
| NANOGrav | North American Nanohertz Observatory for Gravitational Waves |
| NHL | National Historic Landmark |
| NHPA | National Historic Preservation Act |
| NPS | National Park Service |
| NRAO | National Radio Astronomy Observatory |
| NRHP | National Register of Historic Places |
| NRQZ | National Radio Quiet Zone |
| NSF | National Science Foundation |
| PA | Programmatic Agreement |
| SHPO | State Historic Preservation Officer |
| TCP | Traditional Cultural Property |
| USACE | U.S. Army Corps of Engineers |
| U.S.C. | United States Code |
| USGS | U.S. Geological Survey |
| WVU | West Virginia University |

SECTION 1

# Introduction

The National Science Foundation (NSF) has identified the need to divest several facilities from its portfolio to retain the balance of capabilities required to deliver the best performance in key areas of science in the present decade and beyond. Green Bank Observatory (GBO) in Green Bank, Pocahontas County, West Virginia, is one of the facilities identified for potential divestment. This technical report describes the proposed undertaking, presents archeological and architectural identifications and evaluations, and provides an assessment of effects associated with the proposed undertaking. In their letter dated June 12, 2017, the West Virginia State Historic Preservation Officer (SHPO) stated that an assessment of potential effects cannot be completed until a preferred alternative for the GBO project has been selected by NSF during its (concurrent) National Environmental Policy Act (NEPA) review process, which involves preparation of a Draft and Final Environmental Impact Statement (EIS). NSF anticipates identifying a preferred alternative in its upcoming Draft EIS. NSF seeks to coordinate the Section 106 and NEPA processes, as recommended by the Council on Environmental Quality and the Advisory Council on Historic Preservation. As part of this coordination, NSF has developed effects findings for all alternatives. This is needed because of the unique circumstances of this divestment effort and the wide range of alternatives under consideration; if, for example, NSF determines further along in the process that its preferred alternative is not viable, then another alternative would have to be used. To avoid costly delays and duplicative efforts to apply the criteria of adverse effect to another alternative later in the process, NSF has chosen to evaluate the effects of all the alternatives equally and simultaneously. This also helps to inform the NEPA process and selection of the preferred alternative.

## 1.1 Definition of Proposed Undertaking

The potential change to GBO operations is considered a federal undertaking and triggers compliance with Section 106 (54 United States Code [U.S.C.] Section [§] 306108) of the National Historic Preservation Act of 1966 (NHPA), as amended (54 U.S.C. § 300101 *et seq*.), and the NHPA's implementing regulations, "Protection of Historic Properties" (Title 36 *Code of Federal Regulations* [C.F.R.] Part 800). NSF initiated Section 106 consultation with the West Virginia SHPO on December 2, 2016. Section 106 consultation is ongoing.

## 1.2 Proposed Undertaking Background

GBO is located on federal land in Pocahontas County, West Virginia, adjacent to the Monongahela National Forest. This land is owned by NSF and consists of numerous parcels that were acquired by the U.S. Army Corps of Engineers in the 1950s when GBO was formed as the first (and at that time, only) site of the National Radio Astronomy Observatory (NRAO). GBO is the anchor and administrative site of the 13,000-square-mile National Radio Quiet Zone (NRQZ), where all radio transmissions are limited. GBO is situated on approximately 2,200 acres in the NRQZ.

GBO was the initial location of the NRAO and has made astronomical research telescopes available to the scientific community since the late 1950s. The primary research facilities started with an 85-foot telescope in the 1950s, succeeded by the 300-foot telescope (collapsed in 1988) and the 43-meter (140-foot) telescope in the 1960s, the three-element Green Bank Interferometer in the 1960s and 1970s, and then the Robert C. Byrd Green Bank Telescope (GBT) that was dedicated in 2000. Other telescopes have been used for specific project purposes over the course of the 60-year lifetime of GBO.

GBO has a long history of providing science, technology, engineering, and mathematics education, ranging from student training and mentorships to broader outreach and training opportunities. Approximately 50,000 visitors pass through the Green Bank Science Center each year. Those visitors include students, educators, and the general public who generally stay on the site for more than one

night to take advantage of the educational facilities. GBO hosts multiple educational workshops and programs for middle schools through post-graduate student training (NSF, 2017).

The current GBO facilities include the 100-meter Robert C. Byrd GBT, the 43-meter telescope (referred to historically as the 140-foot telescope), the Green Bank Solar Radio Burst Spectrometer (45-foot telescope), the Interferometer Range (includes three 85-foot telescopes), the 20-meter Geodetic Telescope, the 40-foot telescope, historical display telescopes (Jansky Replica Antenna, Reber Radio Telescope, and Ewen-Purcell Horn), support facilities, and infrastructure.

NSF owns GBO and provides funding through a Cooperative Agreement with Associated Universities, Inc. (AUI) for management of the facility. The Breakthrough Prize Foundation provides additional funding to AUI to support research at GBO in the search for extraterrestrial intelligence. Other GBO funding partners include the North American Nanohertz Observatory for Gravitational Waves (NANOGrav) Project (through a separate NSF funding line) and West Virginia University (WVU). On October 1, 2016, GBO was separated from the NSF-funded NRAO. NSF communicated the plan for separation to the research community on March 22, 2013, in a Dear Colleague Letter (NSF 13-074). That letter requested expressions of interest in exploring ideas for future operation and management of GBO.

In 2014, CH2M HILL Engineers, Inc. (CH2M) conducted a cultural resources survey of the architectural resources at GBO. The results of the survey are included in this report under "Determinations of Eligibility." The associated technical report, titled *Cultural Resources Evaluation, Green Bank Observatory, Green Bank, West Virginia*, was submitted to the West Virginia Division of Culture and History, Historic Preservation Office (which houses the SHPO) on December 2, 2016. The West Virginia SHPO concurred with NSF's determinations of eligibility on June 12, 2017.

## 1.3 Proposed Undertaking Description

NSF needs to maintain a balanced research portfolio with the largest science return for the taxpayer dollar. NSF's Division of Astronomical Sciences (AST) is the federal steward for ground-based astronomy in the United States. Its mission is to support forefront research in ground-based astronomy, help ensure the scientific excellence of the U.S. astronomical community, provide access to world-class research facilities through merit review, support the development of new instrumentation and next-generation facilities, and encourage a broad understanding of the astronomical sciences by a diverse population of scientists, policy makers, educators, and the public at large. The AST supports research in all areas of astronomy and astrophysics as well as related multidisciplinary studies. Because of the scale of modern astronomical research, AST engages in numerous interagency and international collaborations. Areas of emphasis and the priorities of specific programs are guided by recommendations of the scientific community, which have been developed and transmitted by National Research Council (NRC, now National Academies) decadal surveys, other National Academies Committees, as well as federal advisory committees, such as the Astronomy and Astrophysics Advisor Committee (AAAC) and the Advisory Committee for the Directorate for Mathematical and Physical Sciences.

At present, GBO serves a variety of scientific user communities in astronomy and astrophysics, and the Observatory is funded for an active education and public outreach program. However, these scientific community evaluations indicate that GBO's science capability is lower in priority than other science capabilities that NSF funds. In a funding-constrained environment, NSF needs to maintain a balanced research portfolio with the largest science return for the taxpayer dollar. Therefore, the purpose of the proposed undertaking is to substantially reduce NSF's contribution to the funding of GBO. NSF has four alternatives to address the need to substantially reduce the NSF's contribution from its current level.

Under each Alternative, some buildings and structures could be demolished; while buildings that could be demolished are identified for analysis purposes, these buildings would not necessarily be demolished. Alternatives A and B are defined by the reduction of NSF funding and the continuance of science- and education-focused operations (under Alternative A) or operation of the Observatory as a

technology and education park (under Alternative B) and not the disposition of any one facility or structure. Use or demolition of any particular building or instrument cannot be determined unless or until a viable collaboration option is under consideration.

Because reduction of NSF funding may require the safe-abandonment, mothballing, or demolition of some facilities, this report describes Alternatives A, B, C, and D under the most conservative (greatest effect) scenario in terms of NSF's analysis of potential changes to facilities, so that it may be inclusive of the full range of potential effects. However, it must be emphasized that a collaboration may not require the full extent of demolition, safe-abandonment, or mothballing activities analyzed and could involve none of the activities described or a subset of those activities. The four Alternatives are described as follows:

- **Action Alternative A – Collaboration with Interested Parties for Science- and Education-focused Operations with Reduced NSF-funded Scope (Agency-preferred Alternative)**: Action Alternative A would involve collaborations with new stakeholder(s) who would use and maintain GBO for science- and education-focused operations. NSF would reduce its funding of the Observatory and the new stakeholder(s) would be responsible for future maintenance and upgrades. Under this Alternative, NSF could transfer or retain the property. Potential transfers could include other federal agencies, commercial interests, or non-profit entities. Action Alternative A would involve the least change to the current facility and would retain the GBT, other appropriate telescopes, and appropriate supporting facilities for education and research as determined by NSF and the new and/or existing stakeholder(s). Any structures not needed to meet the anticipated operational goals would be safe-abandoned[1], mothballed[2], or demolished as appropriate.
- **Action Alternative B – Collaboration with Interested Parties for Operation as a Technology and Education Park**: Action Alternative B would involve collaborating with outside entities to operate and maintain GBO as a technology and education park. In this scenario, the site would focus on tourism and serve as a local attraction. The Science Center, residential hall, cafeteria, and 40-foot telescope would remain active.
- **Action Alternative C – Mothballing of Facilities**: Action Alternative C would involve mothballing (preservation of) essential buildings, telescopes, and other equipment, with periodic maintenance to keep them in working order. This method would allow the facility to suspend operations in a manner that would permit operations to resume efficiently at some time in the future. It is not known what type of operations would be implemented at the end of the mothball phase. Operations at the time of resumption could be similar to current operations, other science-based operations, education-based operations, or some other type of operations. Because of this uncertainty, the resumption of operations is not considered part of this Alternative. A maintenance program would be required to protect the facilities from deterioration, vandalism, and other damage. Regular security patrols would be performed to monitor the site. Common mothballing measures, such as providing proper ventilation, keeping roofs and gutters cleaned of debris, and performing ground maintenance and pest control, would be implemented. Lubrication and other deterioration-preventing measures could be required on the remaining telescopes.

[1] Safe-abandonment: To remove a building or facility from service without demolishing it. This includes removing furnishings, disconnecting utilities, and isolating the structure from public access by fencing or other means to reduce fall and tripping hazards and preclude vandalism. The structure is also made secure from environmental damage due to wind, rain, humidity, and temperature extremes. Pest and insect damage must also be taken into account and biodegradable items must be removed to the maximum extent practicable. Under safe-abandonment, the structures would never be brought back to operational status.

[2] Mothball: To remove a facility or structure from daily use while maintaining the general condition for a defined period. Equipment and structures are kept in working order but are not used.

- **Action Alternative D – Demolition and Site Restoration**: Action Alternative D involves the removal of all structures. Demolition would be accomplished using conventional demolition equipment (cranes, hydraulic excavator equipped with hydraulic-operated shears, grapplers, and hoe rams), other conventional heavy and light duty construction equipment, trades personnel, and trained demolition crews. For safe demolition of the GBT, 43-meter telescope, and water tower, initial demolition would be accomplished using explosives in the form of shaped charges and conventional demolition and/or construction equipment. Exposed below-grade structures would be removed to a maximum of 4 feet to enable the restoration of the ground surface topography.

These Alternatives were refined during the early phases of the compliance review and by public comment.

The term “mothballing” is used in this technical report to refer to the process of removing a facility or structure from daily use while maintaining the general condition for a defined period, and removing equipment and structures from use while keeping them in working order. The National Park Service (NPS) guidelines for mothballing, presented in Preservation Brief 31, “Mothballing Historic Buildings,” applies specifically to historic buildings instead of instruments or equipment (Park, 1993). However, because a similar approach would be used to preserve historic instruments and structures at the GBO, the term “mothballing” is used in this report for both historic instruments and historic buildings to indicate that they will be preserved, protected, and maintained in an operational readiness condition. Historic instruments and equipment at GBO would be protected and preserved in accordance with *The Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for Preserving, Rehabilitating, Restoring and Reconstructing Historic Buildings* (Grimmer, 2017).

# 1.4 Area of Potential Effects

The area of potential effects (APE) for the proposed undertaking is defined as the property boundary of the GBO (Figures 1 and 2). The boundaries of the GBO were determined to be the APE, including all areas where the Alternatives could occur and encompassing all buildings and structures on the property that were 45 years old or older at the time of the cultural resources survey to determine if the GBO constituted a potential historic district. The APE is located on U.S. Geological Survey (USGS) Green Bank (1979) Topographic Quadrangle map (Figure 1). The West Virginia SHPO concurred with the APE on December 22, 2016.

# 1.5 Methodology

There are no known archeological resources at GBO, and no archeological survey work was conducted there as part of the Section 106 process. In addition, no traditional cultural properties (TCPs) have been identified at the GBO. Therefore, archeological resources and TCPs are not analyzed in this technical report.

## 1.5.1 Determinations of Eligibility

A Secretary of the Interior-qualified architectural historian with CH2M conducted an intensive architectural survey of the GBO from 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 historical photographs and narratives, newspaper articles, construction records, and architectural drawings.

Built environment resources from 1969 or earlier within the GBO boundary were surveyed and evaluated, culminating in a determination of eligibility for listing in the National Register of Historic Places (NRHP). Buildings and structures were evaluated individually as well as part of a potential historic district. The field survey encompassed standing structures built in or before 1969. The NRHP age threshold is 50 years; however, using 48 years as the cutoff allowed a buffer for the execution of the proposed undertaking. The Reber Radio Telescope, which is a National Historic Landmark (NHL), was the

only pre-1969 structure that was not individually evaluated because it had been previously listed in the NRHP.

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 5 telescope structures (one of which contains 3 large telescopes), 2 horn instruments, 1 antenna, 1 airstrip, 1 water tower, 1 recreation area, 24 residential buildings, and 12 operational and administrative buildings. One of these telescopes, the Reber Radio Telescope, was previously listed in the NRHP. The remaining 46 built environment resources in the APE were photographed and evaluated for NRHP eligibility. Data collected through the background research and field investigations were analyzed to determine NRHP eligibility of the 46 surveyed built environment resources individually. In addition, the GBT, which was constructed after 1969, was evaluated individually because of its exceptional importance to radio astronomy over the last 50 years. A total of 48 resources (which includes the Reber Radio Telescope and the GBT) were also evaluated as a potential historic district.

The federal historic properties database known as the National Register Information System was reviewed to identify existing historic architectural properties within the APE. A literature review was conducted through the West Virginia SHPO Interactive Map on November 7, 2016. The literature review focused on the APE and included a 0.5-mile buffer around it, defined as the study area. NSF initiated Section 106 consultation with SHPO on December 2, 2016. West Virginia Historic Property Inventory (HPI) forms were completed for 48 architectural resources and were submitted to the SHPO on May 19, 2017, for review and concurrence. The West Virginia SHPO concurred with the determinations of eligibility on June 12, 2017. Figure 2 shows the location of each evaluated built environment resource, and they are listed in Appendix A, *Evaluated Architectural Resources*.

### 1.5.2 Assessment of Effects

As stipulated in 36 C.F.R. 800.1(a), the goal of consultation is to identify historic properties potentially affected by the undertaking, assess the effects on them, and seek ways to avoid, minimize, or mitigate any adverse effects on those historic properties. After historic properties were identified, the Criteria of Adverse Effect were applied to each Alternative. These criteria are used to determine whether the proposed undertaking could change the characteristics that qualify the property for inclusion in the NRHP in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. Section 106 of the NHPA allows three findings for effects on historic properties:

- No Historic Properties Affected
- No Adverse Effect
- Adverse Effect

An effect is adverse under Section 106 if it diminishes the integrity of the property's historically significant characteristics. Examples of adverse effects include, but are not limited to, the following:

- Demolition of the historic property
- Relocation of the historic property
- Introduction of visual, audible, or atmospheric elements that are out of character with the setting of the historic property
- Transfer of ownership of a federally owned property to a non-federal entity

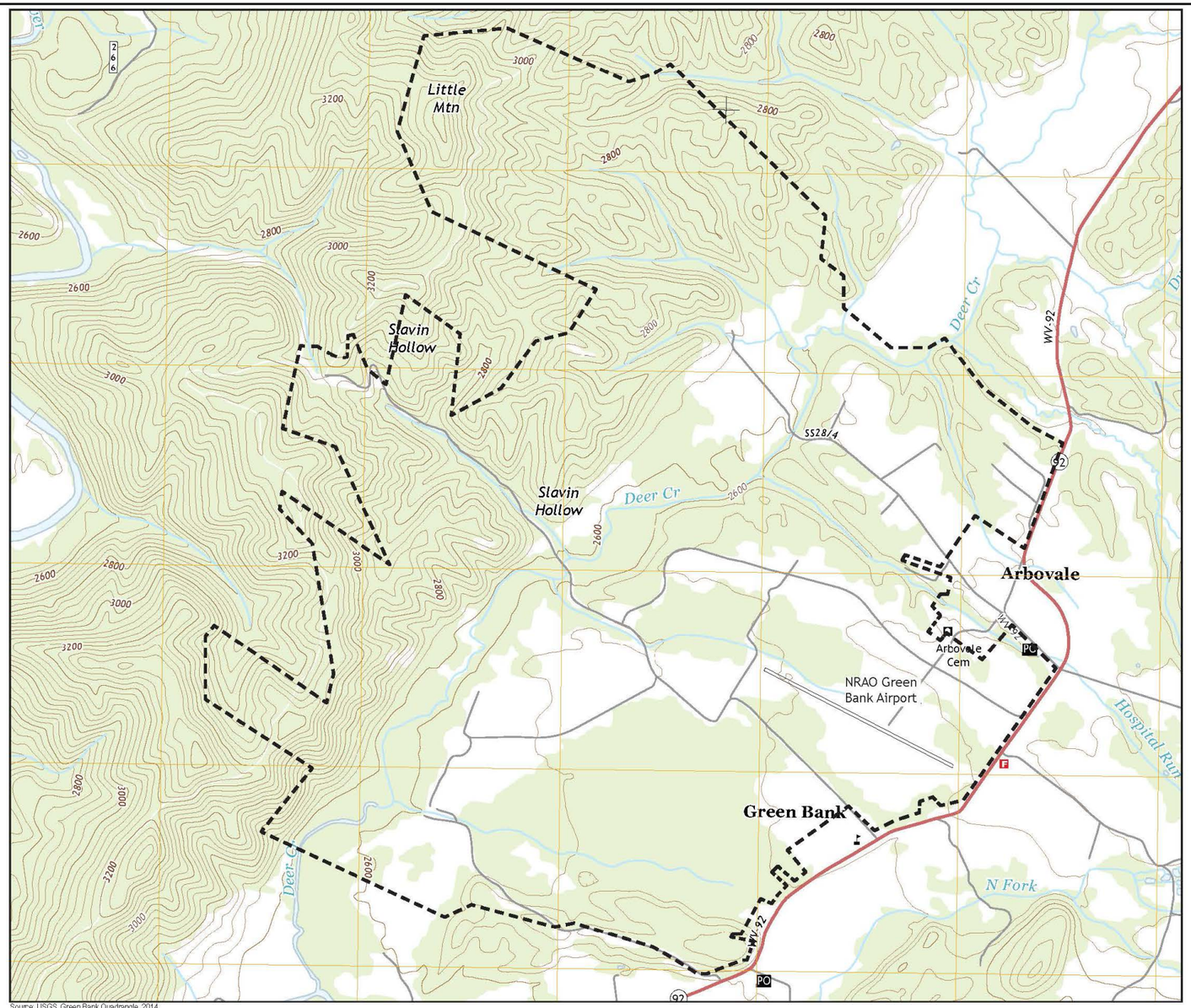
The federal agency makes the determination of effects for each historic property. Based on these determinations, an overall finding of effect for the undertaking is reached in consultation with the SHPO and other consulting parties.

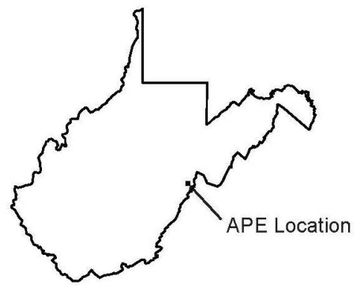
### 1.5.3 Section 106 Resolution of Effects

When an undertaking is found to have an adverse effect, Section 106 requires notification to the Advisory Council on Historic Preservation (ACHP) and consultation with SHPO and other interested parties regarding the appropriate avoidance, minimization, or mitigation measures. Generally speaking, minimization measures might include redesigning aspects of a project to lessen the effects it has on the historic properties. Mitigation may include relocating buildings or structures to move them out of the project footprint or documenting them for archival purposes. For a finding of adverse effect, Section 106 consultation usually results in a Memorandum of Agreement (MOA) or a Programmatic Agreement (PA) per 36 C.F.R. 800.6(c) among the SHPO, federal agency, ACHP, and other consulting parties. This agreement would contain stipulations specifying measures to be implemented that would avoid, minimize, or mitigate the adverse effects. For this proposed undertaking, an MOA or a PA would be drafted to resolve potential adverse effects from the proposed undertaking.

In addition, special protections are given to NHLs, including the statutory requirement that "the agency official, to the maximum extent possible, [will] undertake such planning and actions as may be necessary to minimize harm to any NHL that may be directly and adversely affected by an undertaking" (36 C.F.R. 800.10(a)). The regulation requires consultation with the ACHP as well as the Secretary of the Interior in order to resolve any adverse effects.

NSF has identified Action Alternative A as the Agency-preferred Alternative. However, NSF recognizes that Action Alternative A can occur only if collaborators come forward with viable plans to provide additional non-NSF funding in support of its science-focused operations. Therefore, effects are assessed in this technical report for all Alternatives of the undertaking. Because Action Alternative A has been identified as NSF's Preferred Alternative, the draft MOA or PA would likely address potential adverse effects only from Action Alternative A; if Action Alternative A is ultimately not feasible, NSF would resume Section 106 consultation, focusing on Action Alternatives B through D.




LEGEND

Area of Potential Effects (APE)

North

0 1,700

Approximate scale in feet

FIGURE 1
**Area of Potential Effects (APE)**
Green Bank Observatory
Pocahontas County
*Green Bank, West Virginia*

Source: USGS, Green Bank Quadrangle, 2014

ES111914104239SAC area_potential_effects_greenbank.ai 03-09-17 dash

**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**

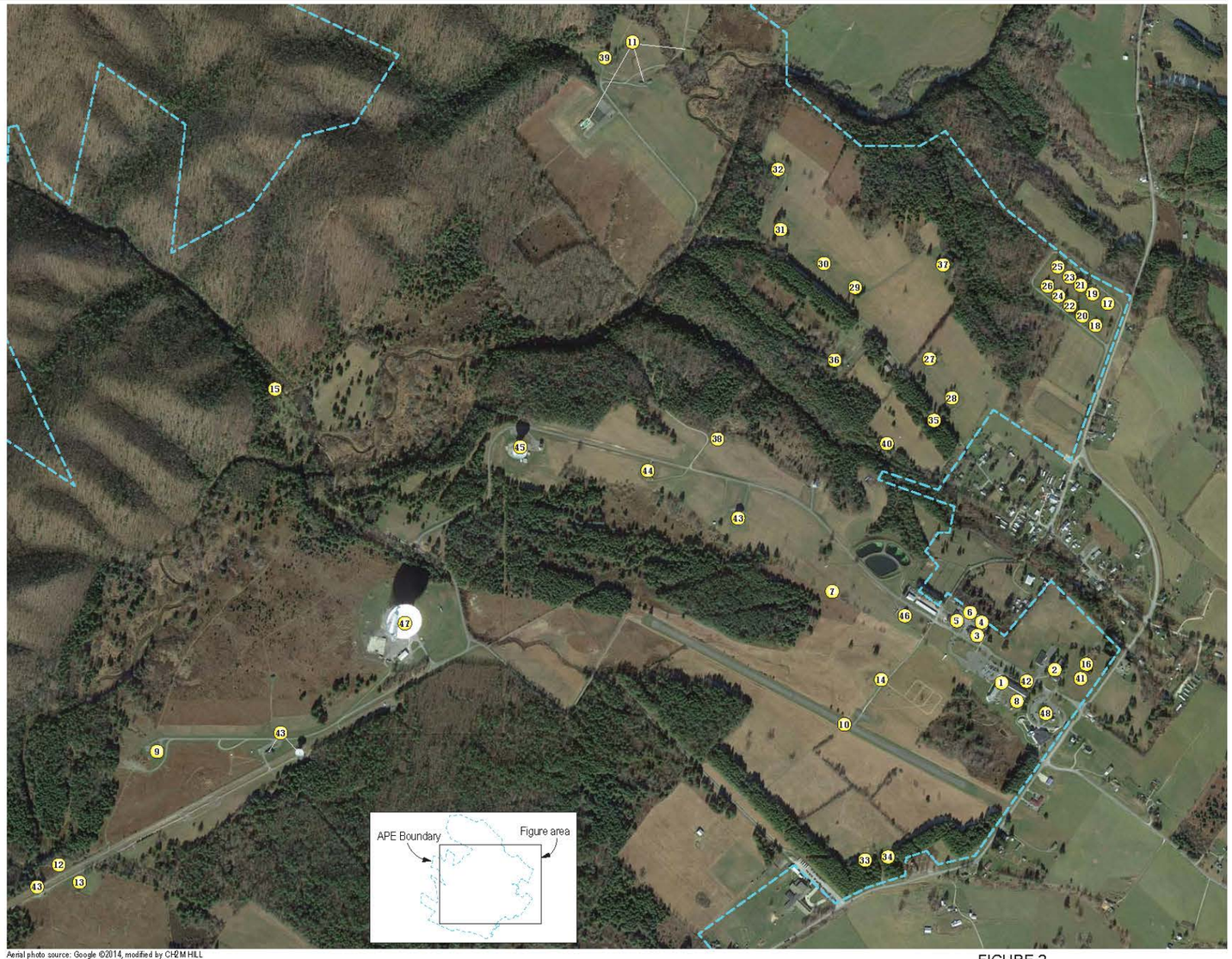
16. Redwood House (House #1; Director's House)
17. House #2 (Rabbit Patch)
18. House #3 (Rabbit Patch)
19. House #4 (Rabbit Patch)
20. House #5 (Rabbit Patch)
21. House #6 (Rabbit Patch)
22. House #7 (Rabbit Patch)
23. House #8 (Rabbit Patch)
24. House #9 (Rabbit Patch)
25. House #10 (Rabbit Patch)
26. 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 2
**Built Environment Resources**
Green Bank Observatory
*Green Bank, West Virginia*

CH2MHILL

ES111914104429SAC built_environment_greenbank.ai 12-08-14 dash

SECTION 2

# Identified Historic Properties

## 2.1 Literature Review

The results of the literature review indicated that the Reber Radio Telescope is the only architectural resource located within GBO that is listed in the NRHP. It was listed in the NRHP in 1972 under Criteria A and B for its nationally significant association with the origins of radio astronomy and for its association with Grote Reber. The Reber Radio Telescope was designated an NHL in 1986.

One residence within the APE, the Riley House (House 15), was recorded on a West Virginia HPI form in 2011. It states on the form that the early twentieth-century wood-frame farm house does not appear to be significant under NRHP Criterion C. The literature review did not identify any prior cultural resources surveys that have occurred within the APE. However, two archeological sites and nine architectural resources have been recorded outside, but directly adjacent to, the APE along State Routes 28 and 92 at the eastern boundary of the Observatory. The two archeological resources were not evaluated for the NRHP. One of the nine architectural resources, the Liberty Presbyterian Church, which was constructed in 1851 on State Route 92, was recorded on two West Virginia HPI forms (PH-0002 and PH-0037-0018). The church is described as significant as an excellent example of Greek Revival architecture, though no formal NRHP evaluation is included with the survey form. Five of the nine architectural resources were evaluated and found to be not eligible for the NRHP, and three of the nine architectural resources were recorded but not evaluated for the NRHP. The cultural resources that have been previously recorded within or directly adjacent to the APE are listed in Table 1. In addition, two surveys (a bridge survey and a cultural resources survey) have occurred and 34 additional cultural resources (5 archeological resources and 29 architectural resources) have been identified within the 0.5-mile study area.

Table 1. Previously Recorded Cultural Resources Within and Directly Adjacent to the APE*

| Resource | Description | Status | Recorded By; Year Recorded |
|---|---|---|---|
| Reber Radio Telescope | 1937 telescope located at the entrance to GBO within APE | NRHP listed 1972; NHL 1986 | NRHP Registration Form |
| Riley House (House 15) PH-0331 | circa 1915 farm house within APE | Not eligible for the NRHP | Justin Greenawalt and Mary Stack (Skelly and Loy, Inc.); 2011 |
| Liberty Presbyterian Church<br>PH-0002<br>PH-0037-0018 | 1851 Greek Revival Church adjacent to APE | Not formally evaluated for the NRHP but described as "significant as an excellent example of Greek Revival architecture in the area" | Michael Gioulis (Historic Preservation Consultant); 1993 |
| George Porter Kerr House – Historic Orlan Shears House PH-0037-0040 | circa 1901 residence adjacent to APE | Not evaluated for the NRHP | Sherron Waybright; 1986 |
| Dr. J.P. Mooumau House PH-0037-0044 | 1873 residence adjacent to APE | Not evaluated for the NRHP | Jessie B. Powell; 1986 |
| Hamed House PH-0037-0048 | 1910 residence adjacent to APE | Not evaluated for the NRHP | Jessie B. Powell; 1986 |
| Jack Nelson House PH-0209 | circa 1900 residence adjacent to the APE | Not eligible for the NRHP | Jeff Drobney (Skelly and Loy, Inc.); 1996 |

Table 1. Previously Recorded Cultural Resources Within and Directly Adjacent to the APE*

| Resource | Description | Status | Recorded By; Year Recorded |
|---|---|---|---|
| Jerry Thortnon House PH-0210 | circa 1880-1890 vernacular residence adjacent to APE | Not eligible for the NRHP | Jeff Drobney (Skelly and Loy, Inc.); 1996 |
| PH-0326 | circa 1920 bungalow residence adjacent to APE | Not eligible for the NRHP | Justin Greenawalt and Mary Stack (Skelly and Loy, Inc.); 2011 |
| PH-0327 | circa 1920 bungalow residence adjacent to APE | Not eligible for the NRHP | Justin Greenawalt and Mary Stack (Skelly and Loy, Inc.); 2011 |
| PH-0332 | 1949 bungalow residence adjacent to APE | Not eligible for the NRHP | Justin Greenawalt and Mary Stack (Skelly and Loy, Inc.); 2011 |
| Shinaberry's Fifth Grade Site 46-PH-64 | Prehistoric archeological site adjacent to APE | Not evaluated for the NRHP | Dick Reigel; 1987 |
| Sheets Site 46-PH-27 | Prehistoric campsite adjacent to APE | Not evaluated for the NRHP | Stephen Davis; 1977 |

* Shaded rows indicate previously recorded resources within the APE.

## 2.2 Brief Historical Context

The sensitive nature of radio telescopes limits the number of potential locations suitable 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. Geographic barriers, such as mountains, help isolate radio signals from space, making valleys an ideal location for the placement of radio telescopes. Green Bank is located in the Deer Creek Valley. In addition to its geographic location encircled by mountains, Green Bank had several other appealing characteristics, such as its rural surroundings, small population, and mild climate. A book published in 1959 by NSF, titled *The National Radio Astronomy Observatory*, provides a historical narrative of the early years of the NRAO site and states, "[t]he large site was selected so that a number of telescopes could be installed and operated without mutual interference" (NSF, 1959).

The land for the GBO was purchased by the U.S. Army Corps of Engineers (USACE) on behalf of NSF in 1957 (NSF, 1959). The Observatory was a small-scale yet fully functioning community, complete with scientific equipment, administrative buildings, laboratories, residences, and recreation facilities. Today the GBO facilities include the GBT, 43-meter telescope (140-foot telescope), 45-foot telescope, Interferometer Range (includes three 85-foot telescopes), 20-meter geodetic telescope, 40-foot telescope, three non-operational historical instruments (Jansky Replica Antenna, Reber Radio Telescope, and Ewen-Purcell Horn), and other support facilities and infrastructure.

This collection of telescopes provides a comprehensive, linear history of radio astronomical observation starting with the Jansky Replica Antenna and ending with the GBT. A complete historical context was included in the technical report titled, *Cultural Resources Evaluation, Green Bank Observatory, Green Bank, West Virginia,* which was submitted to SHPO on December 2, 2016.

## 2.3 Architectural Resources

In 2016, NSF determined that within the historical context of NRAO and GBO, four telescopes are individually eligible for listing in the NRHP: the Interferometer Range (which includes three telescopes

and two control buildings), the 40-foot telescope (which includes an associated control building), the 43-meter telescope (140-foot telescope; includes a maintenance structure), and the GBT. The West Virginia SHPO concurred with these determinations of individual eligibility on December 22, 2016. In the same correspondence, SHPO concurred that the Reber Radio Telescope (NR No. 72001291), which was listed in the NRHP in 1972 and was named an NHL in 1986, remains historically significant. The Reber Radio Telescope, which was constructed in 1937, was moved to the GBO in 1959–1960 to be displayed at the entrance to the Observatory, at which time some elements of the structure, including deteriorated wood pieces, were replaced. The instrument has never been in operation at the GBO.

A total of 48 architectural resources were evaluated for their eligibility for listing in the NRHP as a potential historic district, including 47 architectural resources constructed in or before 1969 and the GBT. NSF determined that 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. Of the 48 architectural resources within the APE, 44 were determined to be contributing to the proposed GBO historic district, the boundaries of which coincide with GBO's property boundaries and the APE. Contributing elements include 8 administrative/operational buildings, 1 airstrip, 1 water tower, 1 recreational area, 24 residential buildings, 2 horn instruments, 1 antenna, and 6 telescopes (the Interferometer includes 3 large telescopes) (see Appendix A and Figure 2). On June 12, 2017, SHPO concurred that the GBO is an NRHP-eligible historic district with 44 contributing resources.

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. The majority of the components that make up the potential district's historic character possess integrity. 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. These elements create a cohesive, visual unit that emphasizes their historically linked function as support for the Observatory, even though many of the buildings are individually undistinguished. As a group, the 44 contributing architectural resources are a distinct and well-preserved representation of the early years of the NRAO. Additionally, the scientific instruments at the GBO illustrate a linear, historical narrative of the history of radio astronomy, from the Jansky Replica Antenna and Reber Radio Telescope to the monumental GBT.

Four buildings within the APE were identified as non-contributing resources: three barns and one orchard cellar building. These buildings pre-date the establishment of the NRAO and have been primarily left vacant or are used as miscellaneous storage facilities. On June 12, 2017, SHPO concurred that these four buildings do not contribute to the NRHP-eligible GBO historic district and are not individually eligible for the NRHP because they were never used for anything beyond random storage for the GBO and they lack individual significance.

Table 2 lists the eligible historic district at the GBO along with the properties that were identified as individually eligible for the NRHP. Appendix A lists the buildings that contribute to the NRHP-eligible historic district.

Table 2. NRHP-Eligible Architectural Properties within the APE

| Resource Name | Year Constructed | Description/Significance | NRHP Eligibility Recommendation |
|---|---|---|---|
| GBO Historic District | 1958–2000 | Collection of administrative/operational buildings and structures, residential buildings, and radio astronomy instruments and equipment associated with the NRAO and GBO. | Eligible (Historic District); 44 contributing resources (Appendix A) |

Table 2. NRHP-Eligible Architectural Properties within the APE

| Resource Name | Year Constructed | Description/Significance | NRHP Eligibility Recommendation |
|---|---|---|---|
| Interferometer Range: Howard E. Tatel Telescope (85'-1) and 85'-1 control building; 85'-2 Telescope; 85'-3 Telescope; and the Interferometer control building<br>PH-0948 | 85'-1: 1958-1959<br>85'-2: 1963-1964<br>85'-3: 1965-1968<br>Interferometer control building: 1967–1968 | The Tatel Telescope (85'-1) was the first telescope constructed by the NRAO and performed the world's first Search For Extra Terrestrial Intelligence (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 under Criterion A and contributing to GBO Historic District |
| 40-foot Telescope and control building<br>PH-0949 | 1962 | First fully automated radio telescope in the world. Currently operates as an educational telescope for visiting students. | Individually eligible under Criterion A and contributing to GBO Historic District |
| 43-meter Telescope (140-foot telescope)<br>PH-0950 | 1958–1965 | Largest telescope in the world to use an equatorial (or polar aligned) mount. Currently used as part of the Russian Radioastron project. | Individually eligible under Criteria A and C and contributing to GBO Historic District |
| GBT<br>PH-0952 | 1991–2000 | Largest moving structure on land in the world; tilt and point design that can rotate a full 360 degrees; performs highly sensitive data collection. | Individually eligible under Criteria A and C, (Consideration G) and contributing to GBO Historic District |

## 2.4 Archeological Resources

The literature review conducted through the West Virginia SHPO Interactive Map did not identify any previously recorded archeological sites within the APE, which has not been surveyed previously for archeological resources. Two archeological sites have been recorded outside the APE, directly adjacent to the eastern boundary of the GBO along State Routes 28 and 92, although the sites have not been evaluated for the NRHP. Additional cultural resources studies have occurred in the 0.5-mile study area, resulting in the recordation of five archeological resources. Based on this research, there are no known archeological resources at GBO. Because there are no known archeological sites present within the APE, no effects to archeological sites are anticipated as a result of the proposed undertaking and effects to archeological sites are not analyzed further in this technical report.

Ground disturbance associated with the proposed undertaking would be limited to those areas within the APE that are developed and have been previously disturbed by construction activities. Alternatives A and B would result in ground disturbance of a similar scale, limited to activities associated with the demolition of buildings and structures at GBO. No tree removal or disturbances to undeveloped areas would be necessary as part of the demolition activities. Demolition activities under Alternative C would be fewer than under Alternatives A or B, because activities would be limited to the demolition of up to nine individual facilities at GBO, three of which are historic properties. Site restoration to establish landscaping where buildings were previously located would occur.

Alternative D would involve more substantial demolition activities and ground disturbance than Alternatives A, B, and C. All facilities and structures would be demolished. For the GBT, 43-meter telescope (140-foot telescope), and water tower, initial demolition (bringing structures to ground level)

would be accomplished using explosives and conventional demolition equipment. Exposed below-grade structures would be removed to a maximum of 4 feet to enable the restoration of the ground surface topography without limiting future surface operations or activities where foundations exist beyond that depth. Site restoration work would include regrading affected areas to desired elevations and contours using available concrete rubble, as necessary, and bringing in fill as needed to establish the grade.

Because no archeological survey work has been conducted as part of the Section 106 process, there may be archeological resources below ground that are not currently apparent. Under all Alternatives, an unanticipated discovery plan would be in place prior to demolition to address any archeological resources that might be discovered during demolition. If previously unidentified archeological resources were discovered during demolition, ground-disturbing activities would halt in the vicinity of the find and NSF would consult with the SHPO and other Consulting Parties as appropriate, as outlined in the unanticipated discovery plan, regarding eligibility for listing in the NRHP, project effects, necessary mitigation, or other treatment measures. Additional archeological investigations could be conducted if substantial ground disturbance is required or if work is performed in areas that are currently undisturbed.

SECTION 3

# Assessment of Effects

The following sections describe the potential effects on historic properties as a result of the four Alternatives in the proposed undertaking.

## 3.1 Alternative A: Collaboration with Interested Parties for Science- and Education-focused Operations with Reduced NSF-funded Scope (Agency-preferred Alternative)

### 3.1.1 NRHP Contributing, Individually Eligible, and Listed Architectural Resources

Alternative A involves the demolition, mothballing, and safe-abandonment of historic properties and would result in adverse effects under Section 106. Table 3 lists the proposed activities that would affect all historic properties under Alternative A except for the eligible historic district, which is discussed in Section 3.1.2. Additional facilities not listed in Table 3 could be demolished under Alternative A; however, to assess the potential effects to historic properties, only those properties at the GBO that are eligible for, or listed in, the NRHP are included in the table. Any historic properties not listed in Table 3, including the GBT, other telescopes, and supporting facilities for education and research, would be retained and maintained as determined by NSF and the new and/or existing stakeholder(s).

Table 3. Alternative A – Description of Proposed Activities

| Proposed Activity | Alternative A: Collaboration with Interested Parties for Science- and Education-focused Operations with Reduced NSF-funded Scope |
|---|---|
| Historic properties that could be demolished | 45-foot Telescope |
| | 300-foot Telescope Control Building (also known as Laser Lab) |
| | *Interferometer Range (Telescope 85-1 [Tatel Telescope]) and 85-1 Control Building; Telescope 85-2; Telescope 85-3; Interferometer Control Building) ** |
| | Calibration Horn |
| | Recreation Area |
| | Nut Bin |
| | Shinnaberry House |
| | Tracey House |
| | Beard House |
| | Hill House |
| | House 2 (Rabbit Patch) |
| | House 3 (Rabbit Patch) |
| | House 4 (Rabbit Patch) |
| | House 5 (Rabbit Patch) |
| | House 6 (Rabbit Patch) |
| | House 7 (Rabbit Patch) |
| | House 8 (Rabbit Patch) |
| | House 9 (Rabbit Patch) |
| | House 10 (Rabbit Patch) |
| | House 11 (Rabbit Patch) |

Table 3. Alternative A – Description of Proposed Activities

| Proposed Activity | Alternative A: Collaboration with Interested Parties for Science- and Education-focused Operations with Reduced NSF-funded Scope |
|---|---|
| | House 14 |
| | House 16 |
| | House 19 |
| | House 21 |
| | House 23 |
| | House 24 |
| | Millimeter Array Experiment Building |
| Historic properties that could be safe-abandoned | *43-meter Telescope (140-foot Telescope)* |
| Historic properties that could be mothballed | *Reber Radio Telescope (NHL)* |
| | Jansky Replica Antenna |
| | Ewen-Purcell Horn |

* Resources in *italics* are individually eligible for, or listed in, the NRHP.

### Demolition

An individually NRHP-eligible telescope array (the Interferometer Range, which includes 3 large telescopes) and 26 resources that contribute to the NRHP-eligible district could be demolished as a result of Alternative A. Alternative A involves the demolition of historic properties at the GBO; therefore, Alternative A would result in an adverse effect under Section 106. In addition, if ownership of GBO is transferred to a non-federal entity under Alternative A, this would be considered an adverse effect to historic properties under Section 106 because the NHPA would no longer be applicable, as described below. As appropriate, NSF will continue to consult with the West Virginia SHPO and other Consulting Parties to determine suitable avoidance, minimization, and mitigation measures. It is anticipated that these measures would be stipulated in an MOA or a PA.

### Safe-abandonment

One individually NRHP-eligible telescope (the 43-meter telescope [140-foot telescope]) could be safe-abandoned as a result of Alternative A. Preparing the structure for safe-abandonment would involve securing the structure to avoid environmental damage resulting from wind, rain, humidity, and extreme temperatures. The structure would be isolated from public access through the installation of fencing or other means to reduce trip and fall hazards and prevent vandalism. Securing the overall structure could involve slight alterations that might diminish the integrity of the structure's materials, design, or setting. These alterations would be noticeable but initially would not substantially diminish the primary characteristics of the 43-meter telescope (140-foot telescope) that qualify it for listing in the NRHP. Specific measures, agreed upon in consultation with the West Virginia SHPO and other Consulting Parties, would ensure that the effects to the historic structure are minimized and would be sufficient to result in a finding of no adverse effect under Section 106.

### Mothballing

One NRHP-listed telescope (the Reber Radio Telescope), which is also an NHL, and two contributing resources to the NRHP-eligible historic district (Jansky Replica Antenna and Ewen-Purcell Horn) would be mothballed as a result of Alternative A. However, all three resources proposed for potential mothballing are non-operational display instruments that are not in active use. The Ewen-Purcell Horn is a small instrument that was originally used at Harvard University and later was mounted on two concrete piers

clad in stone veneer as a display item at GBO. The Reber Radio Telescope has served as a display instrument since it was moved to GBO in 1959–1960 and the Jansky Replica Antenna was constructed as a display structure. Therefore, the instruments have already been preserved and protected as display instruments. Few, if any, steps would be required to mothball these structures and ensure that they are secured. No physical alterations to the instruments are anticipated and preparations would result in no adverse effect under Section 106. If any additional actions were required to secure the structures, they would be executed in accordance with *The Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for Preserving, Rehabilitating, Restoring and Reconstructing Historic Buildings* (Grimmer, 2017). Anything done as part of the mothballing process could be reversed in the future without physical harm to the historic fabric. If these preparations could affect the Reber Radio Telescope, consultation with the ACHP and the Secretary of the Interior would occur before mothballing the NRHP-listed structure, which is a designated NHL.

**Operation**

Individual structures within GBO that are proposed for potential safe-abandonment or mothballing could experience some effects as a result of operations. Under Alternative A, one historic telescope (the 43-meter telescope [140-foot telescope]) would be safe-abandoned and three historic display instruments (Reber Radio Telescope, Jansky Replica Antenna, and Ewen-Purcell Horn) would be mothballed. The three instruments that would be mothballed are non-operational display instruments that are not currently in active use. Therefore, mothballing these instruments would not alter the existing operations of the instruments.

Safe-abandonment of the 43-meter telescope (140-foot telescope), which is individually NRHP-eligible and contributes to the NRHP-eligible historic district, would involve removing the radio telescope from service and isolating the structure from public access, which would result in a change of use. The 43-meter telescope (140-foot telescope) is eligible for the NRHP for its important association with events that have made a significant contribution to radio astronomy and for its design and engineering. Because the radio telescope is a scientific instrument, its use is a primary component of its significance. Although the structure would remain extant, a change of use would diminish its integrity of feeling and association. In addition, as a result of lack of maintenance and use, the safe-abandonment of the telescope under Alternative A would result in a gradual deterioration of the structure’s physical integrity, including its materials, workmanship, and design. Overall, the safe-abandonment of the 43-meter telescope (140-foot telescope) as an active instrument would diminish the NRHP-eligible instrument’s integrity of materials, feeling, setting, design, workmanship, and association. The decline in the structure’s integrity could ultimately result in an adverse effect under Section 106.

### 3.1.2 Historic District

Although a total of 26 contributing resources could be demolished under Alternative A, including one individually NRHP-eligible telescope, the remaining 18 contributing resources would be retained, either as active facilities or as safe-abandoned or mothballed instruments. Three telescopes within the GBO (the GBT, the 43-meter telescope [140-foot telescope], and the 40-foot telescope [and its associated control building]), which are individually eligible for the NRHP and important focal points of the property, would be retained. In addition, a selection of other building types would be preserved, including several administrative/operational support buildings and a small selection of residential buildings. As a result, Alternative A would preserve a collection of facilities that are significant in the development of radio astronomy and are representative of the various building and structure types that are currently extant. Therefore, the historic district would retain sufficient integrity to convey its historic significance. The effects to the GBO historic district as a whole would not be considered adverse under Section 106.

Under Alternative A, NSF could retain or transfer the property. If the property were transferred to a non-federal entity, the Section 106 consultation process would no longer apply to future actions by any new owner. If the future new owner made changes that could affect one or more contributing elements to the historic district, that owner would not be required to consult with SHPO under Section 106 of the NHPA to determine ways to avoid, minimize, or mitigate the adverse effects. Therefore, a change in ownership to a non-federal entity would result in adverse effects under Section 106. NSF would consult with the West Virginia SHPO, ACHP, and other Consulting Parties to determine the appropriate ways in which to avoid, minimize, or mitigate this effect. Measures that resulted from these consultations would be documented in the MOA or PA and would include provisions that NSF would require of any new owner as a part of a future property transfer.

### 3.1.3 Summary

Alternative A involves the demolition of historic properties. As a result, the overall finding of effect for the Alternative is an Adverse Effect to historic properties.

## 3.2 Alternative B: Collaboration with Interested Parties for Operation as a Technology and Education Park

### 3.2.1 NRHP Contributing, Individually Eligible, and Listed Architectural Resources

Similar to Alternative A, Alternative B involves the demolition of facilities at the GBO that are individually eligible for the NRHP and that contribute to the NRHP-eligible historic district; therefore, Alternative B would result in adverse effects under Section 106. Table 4 lists the proposed activities that would affect all historic properties under Alternative B except for the eligible historic district, which is discussed in Section 3.1.2. Additional facilities not listed in Table 4 could be demolished; however, to assess the potential effects to historic properties, only those properties at GBO that are eligible for, or listed in, the NRHP are included in the table. Any historic properties not listed in Table 4 would be retained and maintained.

Table 4. Alternative B – Description of Proposed Activities

| Proposed Activity | Alternative B: Collaboration with Interested Parties for Operation as a Technology and Education Park |
|---|---|
| Historic properties that could be demolished | 45-foot Telescope |
| | 300-foot Telescope Control Building (also known as Laser Lab) |
| | Coaxial Cable Building (also known as Telescope Mechanics Office) |
| | *Interferometer Range (Telescope 85-1 [Tatel Telescope]) and 85-1 Control Building; Telescope 85-2; Telescope 85-3; Interferometer Control Building)** |
| | Calibration Horn |
| | Recreation Area |
| | Nut Bin |
| | Shinnaberry House |
| | Redwood House (also known as Director's House, House 1) |
| | Tracey House |
| | Riley House |
| | Beard House |
| | Hill House |
| | Hannah House |
| | House 2 (Rabbit Patch) |

Table 4. Alternative B – Description of Proposed Activities

| Proposed Activity | Alternative B: Collaboration with Interested Parties for Operation as a Technology and Education Park |
|---|---|
| | House 3 (Rabbit Patch) |
| | House 4 (Rabbit Patch) |
| | House 5 (Rabbit Patch) |
| | House 6 (Rabbit Patch) |
| | House 7 (Rabbit Patch) |
| | House 8 (Rabbit Patch) |
| | House 9 (Rabbit Patch) |
| | House 10 (Rabbit Patch) |
| | House 11 (Rabbit Patch) |
| | House 14 |
| | House 16 |
| | House 19 |
| | House 21 |
| | House 23 |
| | House 24 |
| | Millimeter Array Experiment Building |
| Historic properties that could be safe-abandoned | *43-meter Telescope (140-foot Telescope)* |
| | *GBT* |
| Historic properties that could be mothballed | *Reber Radio Telescope* |
| | Jansky Replica Antenna |
| | Ewen-Purcell Horn |

* Resources in *italics* are individually eligible for, or listed in, the NRHP.

### Demolition

Demolition activities for Alternative B would be similar to Alternative A; both involve the demolition of historic properties but would avoid complete demolition of the historic district. However, under Alternative B, four additional historic properties would be demolished, for a total of 31 properties. This would result in an adverse effect under Section 106. As appropriate, NSF would continue to consult with the West Virginia SHPO, ACHP, and other Consulting Parties to determine suitable avoidance, minimization, and mitigation measures. It is anticipated that these measures would be stipulated in an MOA or a PA.

### Safe-abandonment

As with Alternative A, Alternative B would involve the safe-abandonment of the 43-meter telescope (140-foot telescope); however, Alternative B would also involve the safe-abandonment of the GBT, which is one of the primary focal points of the NRHP-eligible historic district. Preparing the structure for safe-abandonment would involve securing the structure to avoid environmental damage resulting from wind, rain, humidity, and extreme temperatures. The structure would be isolated from public access through the installation of fencing or other means to reduce trip and fall hazards and prevent vandalism. Securing the overall structure could involve minor alterations that might diminish the integrity of the structure's materials, design, or setting. These alterations would be noticeable but would not substantially diminish the primary characteristics of the GBT that qualify it for listing in the NRHP. Specific measures, agreed upon in consultation with the West Virginia SHPO, ACHP, and other

Consulting Parties, would ensure that the effects to the historic structure are minimized and would potentially be sufficient to result in a finding of no adverse effect under Section 106.

**Mothballing**

Mothballing activities under Alternative B would be identical to Action Alternative A and the effects would not be considered adverse under Section 106.

**Operation**

After demolition, operations would continue under Alternative B as a technology and education park with more of a tourism and local attraction focus. The change of use from a functioning radio observatory to a technology and education park would diminish the integrity of feeling and association of the GBO's historic properties.

As with Alternative A, the 43-meter telescope (140-foot telescope) would be safe-abandoned and three non-operational display instruments (Reber Radio Telescope, Jansky Replica Antenna, and the Ewen-Purcell Horn) would be mothballed under Alternative B. Therefore, effects to these four historic properties as result of operation of Alternative B would be the same as those described for Alternative A. The same measures that were described for Alternative A could be implemented to ensure that the effects over time of mothballing the three historic properties are minimized.

However, under Alternative B, the GBT would experience additional effects during operation, because safe-abandonment of the GBT would involve removing the radio telescope from service and isolating the structure from public access, which would result in a change of use. Because the radio telescope is a scientific instrument, its use is a primary component of its significance. Although the structure would remain extant, a change of use would diminish its integrity of feeling and association. In addition, as a result of the lack of maintenance and use, the safe-abandonment of the GBT under Alternative B could result in a gradual deterioration of the structure's physical integrity, including its materials, workmanship, and design. Overall, the safe-abandonment of the GBT would diminish the NRHP-eligible structure's integrity of materials, feeling, setting, design, workmanship, and association. As described under Alternative A for the 43-meter telescope (140-foot telescope), the decline in the GBT's integrity could ultimately result in an adverse effect under Section 106.

### 3.2.2 Historic District

As with Alternative A, Alternative B would preserve a collection of facilities that are significant in the development of radio astronomy as active facilities or as safe-abandoned or mothballed instruments. The deterioration of individual structures as a result of safe-abandonment would be noticeable but would not appreciably alter the historic district's characteristics. Overall, the historic district would retain sufficient integrity to convey its historic significance, resulting in no adverse effect under Section 106 to the historic district as a whole.

NSF could retain or transfer the property under Alternative B. As described for Alternative A, if the property was transferred to a non-federal entity, the Section 106 consultation process would no longer be applicable to future actions by any new owner and would therefore result in an adverse effect under Section 106. Requirements to resolve adverse effects to the historic district for Alternative B as a result of a potential property transfer out of federal ownership would be the same as those described for Alternative A.

### 3.2.3 Summary

Alternative B involves the demolition of historic properties. As a result, the overall finding of effect for the Alternative is an Adverse Effect to historic properties.

# 3.3 Alternative C: Mothballing of Facilities

## 3.3.1 NRHP Contributing, Individually Eligible, and Listed Architectural Resources

Alternative C involves the demolition of facilities at the GBO that are individually eligible for the NRHP and that contribute to the NRHP-eligible historic district; therefore, Alternative C would result in adverse effects under Section 106. Table 5 lists the proposed activities that would affect all historic properties under Alternative C except for the eligible historic district, which is discussed in Section 3.3.2. Additional facilities not listed in Table 5 could be demolished under Alternative C; however, to assess the potential effects to historic properties, only those properties at GBO that are eligible for, or listed in, the NRHP are included in the table. Any historic properties not listed in Table 5 would be retained and maintained.

Table 5. Alternative C – Description of Proposed Activities

| Proposed Activity | Alternative C: Mothballing of Facilities |
|---|---|
| Historic properties that could be demolished | *Interferometer Range (Telescope 85-1 [Tatel Telescope]) and 85-1 Control Building; Telescope 85-2; Telescope 85-3; Interferometer Control Building)** |
| | Calibration Horn |
| | Beard House |
| | Millimeter Array Experiment Building |
| Historic properties that could be mothballed | *40-foot Telescope* |
| | *43-meter Telescope (140-foot Telescope)* |
| | 45-foot Telescope |
| | 300-foot Telescope Control Building (also known as Laser Lab) |
| | Coaxial Cable Building (also known as Telescope Mechanics Office) |
| | *GBT* |
| | *Reber Radio Telescope* |
| | Jansky Replica Antenna |
| | Ewen-Purcell Horn |
| | Jansky Laboratory (which includes the Outdoor Test Building) |
| | Warehouse |
| | Water Tower |
| | Works Area Building |
| | Airstrip |
| | Recreation Area |
| | Residence Hall & Cafeteria |
| | Nut Bin |
| | Shinnaberry House |
| | Redwood House (also known as Director's House, House 1) |
| | Tracey House |
| | Riley House |
| | Hill House |
| | Hannah House |
| | House 2 (Rabbit Patch) |
| | House 3 (Rabbit Patch) |
| | House 4 (Rabbit Patch) |
| | House 5 (Rabbit Patch) |
| | House 6 (Rabbit Patch) |
| | House 7 (Rabbit Patch) |
| | House 8 (Rabbit Patch) |

Table 5. Alternative C – Description of Proposed Activities

| Proposed Activity | Alternative C: Mothballing of Facilities |
|---|---|
| | House 9 (Rabbit Patch) |
| | House 10 (Rabbit Patch) |
| | House 11 (Rabbit Patch) |
| | House 14 |
| | House 16 |
| | House 19 |
| | House 21 |
| | House 23 |
| | House 24 |

* Resources in *italics* are individually eligible for, or listed in, the NRHP.

**Demolition**

Demolition activities under Alternative C would affect fewer buildings and structures than under Alternatives A or B; however, an individually NRHP-eligible telescope array (the Interferometer Range, which includes three large telescopes) and three contributing resources (the Calibration Horn, Beard House, and the Millimeter Array Experiment Building) would be demolished under Alternative C. This would result in an adverse effect under Section 106. As appropriate, NSF would continue to consult with the West Virginia SHPO, ACHP, and other Consulting Parties to determine suitable avoidance, minimization, and mitigation measures. It is anticipated that these measures would be stipulated in an MOA or a PA.

**Safe-abandonment**

No buildings or structures would be safe-abandoned under Alternative C; therefore, there would be no associated effects.

**Mothballing**

Forty historic properties would be mothballed under Alternative C. Avoiding demolition of historic properties means the properties would be preserved for potential future use. Of the four alternatives, Alternative C would retain the largest collection of contributing buildings as a historic district that conveys the significant development of radio astronomy. Preparing historic properties for mothballing would involve securing buildings and their associated components, turning off utilities, weatherizing, and providing adequate ventilation. These steps could involve some building treatments that would have no adverse effect under Section 106. Any modifications to buildings required during mothballing would be compatible with the historic property's style and materials and would be executed in accordance with the NPS's Preservation Brief 31, "Mothballing Historic Buildings" (Park, 1993). Mothballing of historic instruments and equipment would follow *The Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for Preserving, Rehabilitating, Restoring and Reconstructing Historic Buildings* (Grimmer, 2017). If historic properties were returned to use at a future date, any alterations performed as part of the mothballing process could be reversed without physical harm to the historic fabric. The Reber Radio Telescope is a preserved display instrument, and therefore, it is not anticipated that additional actions to mothball the structure would be required. However, if additional actions were required to secure the instrument that could affect the historic structure, consultation with the ACHP and the Secretary of the Interior would occur before mothballing the NRHP-listed Reber Radio Telescope, which is a designated NHL. Of the four Alternatives, Alternative C would result in the least effects to historic properties.

**Post-demolition and Safe-abandonment Activities**

Under Alternative C, all remaining contributing resources to the NRHP-eligible historic district would be mothballed, which would involve removing each facility from daily use and maintaining the general condition of each historic property for a defined period. Mothballing the NRHP-listed, NHL-designated instrument (Reber Radio Telescope), three individually NRHP-eligible telescopes (40-foot telescope, 43-meter telescope [140-foot telescope], and the GBT), and the 37 remaining contributing resources to the NRHP-eligible historic district would alter the use and setting of these properties. In addition, the 40-foot telescope, the 43-meter telescope (140-foot telescope), the GBT, and many of the resources that contribute to the NRHP-eligible historic district have achieved historic significance through their use as tools for furthering the field of radio astronomy. For these reasons, if the properties were mothballed, the contributing historic properties would suffer a loss of association and feeling.

However, mothballed resources could be returned to use at a future time, which would restore the district's integrity of association and feeling. Specific measures could ensure that the effects from mothballing resources are minimized. These measures could include photographic documentation of the historic properties at the GBO, a detailed conditions assessment of the contributing resources, compliance with certain security and maintenance standards, and regular monitoring of the buildings and structures that contribute to the NRHP-eligible historic district. A maintenance program could protect the facilities from deterioration, vandalism, and other damage. Regular security patrols could be performed to monitor the site. Common mothballing measures, such as providing proper ventilation, keeping roofs and gutters cleaned of debris, and performing ground maintenance and pest control, could be implemented. Lubrication and other deterioration-preventing measures could be required on the remaining telescopes. These types of measures would ensure the future survival of the historic properties that contribute to the eligible historic district. Mothballing would be carefully planned and completed in accordance with the NPS's Preservation Brief 31, "Mothballing Historic Buildings" (Park, 1993) and *The Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for Preserving, Rehabilitating, Restoring and Reconstructing Historic Buildings* (Grimmer, 2017). Following the procedures outlined in these references, operations under Alternative C would result in no adverse effect under Section 106.

### 3.3.2 Historic District

Although a few contributing resources would be demolished, a majority of contributing resources within the historic district, including several of the primary instruments, would be preserved and maintained under Alternative C. Overall, the historic district would retain sufficient integrity to convey its historic significance, resulting in no adverse effect under Section 106 to the historic district as a whole.

### 3.3.3 Summary

Alternative C involves the demolition of historic properties. As a result, the overall finding of effect for Alternative C is an Adverse Effect to historic properties. However, Alternative C would retain the greatest number of historic properties of the four Alternatives.

## 3.4 Alternative D: Demolition and Site Restoration

### 3.4.1 NRHP Contributing, Individually Eligible, and Listed Architectural Resources

Alternative D involves the demolition of facilities at the GBO that are individually eligible for the NRHP and that contribute to the NRHP-eligible historic district; therefore, Alternative D would result in adverse effects under Section 106. Table 6 lists proposed activities that would affect all historic properties under Alternative D except for the eligible historic district, which is discussed in Section 3.4.2. Additional facilities not listed in Table 6 would be demolished under Alternative D; however, to assess the potential effects to historic properties, only properties at GBO that are eligible for, or listed in, the NRHP are included in the table.

Table 6. Alternative D – Description of Proposed Activities

| Proposed Activity | Alternative D: Demolition and Site Restoration |
|---|---|
| Historic properties that could be demolished | *40-foot Telescope** |
| | *43-meter Telescope (140-foot Telescope)* |
| | 45-foot Telescope |
| | 300-foot Telescope Control Building (also known as Laser Lab) |
| | Coaxial Cable Building (also known as Telescope Mechanics Office) |
| | *GBT* |
| | Jansky Replica Antenna |
| | Ewen-Purcell Horn |
| | Interferometer Range (Telescope 85-1 [Tatel Telescope]) and 85-1 Control Building; Telescope 85-2; Telescope 85-3; Interferometer Control Building) |
| | Jansky Laboratory (which includes the Outdoor Test Building) |
| | Calibration Horn |
| | Warehouse |
| | Water Tower |
| | Works Area Building |
| | Airstrip |
| | Recreation Area |
| | Residence Hall & Cafeteria |
| | Nut Bin |
| | Shinnaberry House |
| | Redwood House (also known as Director's House, House 1) |
| | Tracey House |
| | Riley House |
| | Beard House |
| | Hill House |
| | Hannah House |
| | House 2 (Rabbit Patch) |
| | House 3 (Rabbit Patch) |
| | House 4 (Rabbit Patch) |
| | House 5 (Rabbit Patch) |
| | House 6 (Rabbit Patch) |
| | House 7 (Rabbit Patch) |
| | House 8 (Rabbit Patch) |
| | House 9 (Rabbit Patch) |
| | House 10 (Rabbit Patch) |
| | House 11 (Rabbit Patch) |
| | House 14 |
| | House 16 |
| | House 19 |
| | House 21 |
| | House 23 |
| | House 24 |
| | Millimeter Array Experiment Building |

Table 6. Alternative D – Description of Proposed Activities

| Proposed Activity | Alternative D: Demolition and Site Restoration |
|---|---|
| Historic properties that could be relocated | *Reber Radio Telescope* |

* Resources in *italics* are individually eligible for, or listed in, the NRHP.

**Demolition**

Alternative D would involve the demolition of nearly all historic properties at GBO, resulting in an adverse effect to historic properties under Section 106. Only the Reber Radio Telescope would be preserved and relocated. Therefore, of the four Alternatives, Alternative D would incur the most severe effects to historic properties. As appropriate, NSF would continue to consult with the West Virginia SHPO, ACHP, and other Consulting Parties to determine suitable avoidance, minimization, and mitigation measures. It is anticipated that these measures would be stipulated in an MOA or a PA.

**Mothballing**

No buildings or structures would be mothballed under Alternative D; therefore, there would be no associated effects.

**Safe-abandonment**

No buildings or structures would be safe-abandoned under Alternative D; therefore, there would be no associated effects.

**Post-demolition Activities**

Operations would completely cease under Alternative D; therefore, operation of Alternative D would result in no historic properties affected under Section 106.

### 3.4.2 Historic District

The complete demolition of GBO would result in the elimination of an NRHP-eligible historic district. Alternative D would result in an adverse effect to historic properties under Section 106. NSF would continue to consult with the West Virginia SHPO, ACHP, and other Consulting Parties to determine the appropriate mitigation.

### 3.4.3 Summary

Alternative D involves the demolition of nearly all historic properties that contribute to a NRHP-eligible historic district. Therefore, the overall finding of effect for Alternative D is an Adverse Effect to historic properties.

SECTION 4

# Conclusion

The GBO is eligible for the NRHP as a historic district with 44 contributing resources. Four of the contributing resources are also individually eligible for listing in the NRHP:

- Interferometer Range
- 40-foot Telescope
- 43-meter Telescope (140-foot Telescope)
- GBT

Under Action Alternatives A, B, C, and D, historic properties that contribute to the NRHP-eligible historic district could be demolished, resulting in a finding of Adverse Effect under Section 106.

SECTION 5

# References

Grimmer, Anne E. 2017. *The Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for Preserving, Rehabilitating, Restoring & Reconstructing Historic Buildings.* U.S. Department of the Interior. National Park Service. Technical Preservation Services. Washington, D.C. From *The Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for Preserving, Rehabilitating, Restoring and Reconstructing Historic Buildings* by Kay D. Weeks and Anne E. Grimmer (1995), revised 2017. Accessed July 18, 2017. https://www.nps.gov/tps/standards/treatment-guidelines-2017.pdf

National Science Foundation (NSF). 1959. *The National Radio Astronomy Observatory*.

National Science Foundation (NSF). 2017. Response to CH2M HILL's request for information on Green Bank Observatory permanent staff by zip code of residency. March 20.

Park, Sharon C. 1993. Preservation Brief 31: Mothballing Historic Buildings. Technical Preservation Services. National Park Service. U.S. Department of the Interior.

# Appendix A
# Evaluated Architectural Resources

| HPI Site Number | Resource Type | Resource Name | NRHP Status |
|---|---|---|---|
| PH-0907 | Administrative/ Operational | Karl Guthe Jansky Laboratory | Eligible as a contributing resource to the GBO Historic District |
| PH-0908 | Administrative/ Operational | Cafeteria Building and Residence | Eligible as a contributing resource to the GBO Historic District |
| PH-0909 | Administrative/ Operational | Warehouse | Eligible as a contributing resource to the GBO Historic District |
| PH-0910 | Other | Water Tower | Eligible as a contributing resource to the GBO Historic District |
| PH-0911 | Administrative/ Operational | Works Area Building | Eligible as a contributing resource to the GBO Historic District |
| PH-0912 | Administrative/ Operational | Telescope Mechanics Office (formerly Cable Storage Warehouse) | Eligible as a contributing resource to the GBO Historic District |
| PH-0913 | Administrative/ Operational | Millimeter Array Experiment Building | Eligible as a contributing resource to the GBO Historic District |
| PH-0914 | Administrative/ Operational | Outdoor Test Building | Eligible as a contributing resource to the GBO Historic District |
| PH-0915 | Administrative/ Operational | Laser Lab (formerly 300' Telescope Control Building) | Eligible as a contributing resource to the GBO Historic District |
| PH-0916 | Other | Airstrip | Eligible as a contributing resource to the GBO Historic District |
| PH-0917 | Other | Recreation Area | Eligible as a contributing resource to the GBO Historic District |
| PH-0918 | Other/Storage | Barn | Not eligible/non-contributing |
| PH-0919 | Other/Storage | Barn | Not eligible/non-contributing |
| PH-0920 | Other/Storage | Barn | Not eligible/non-contributing |
| PH-0921 | Vacant | Slaven Hollow Orchard Cellar Building | Not eligible/non-contributing |
| PH-0922 | Residential | Redwood House; Director's House (House 1) | Eligible as a contributing resource to the GBO Historic District |
| PH-0923 | Residential | House 2 (Rabbit Patch) - 2 Rabbit Patch | Eligible as a contributing resource to the GBO Historic District |
| PH-0924 | Residential | House 3 (Rabbit Patch) - 3 Rabbit Patch | Eligible as a contributing resource to the GBO Historic District |

| HPI Site Number | Resource Type | Resource Name | NRHP Status |
|---|---|---|---|
| PH-0925 | Residential | House 4 (Rabbit Patch) - 4 Rabbit Patch | Eligible as a contributing resource to the GBO Historic District |
| PH-0926 | Residential | House 5 (Rabbit Patch) - 5 Rabbit Patch | Eligible as a contributing resource to the GBO Historic District |
| PH-0927 | Residential | House 6 (Rabbit Patch) - 6 Rabbit Patch | Eligible as a contributing resource to the GBO Historic District |
| PH-0928 | Residential | House 7 (Rabbit Patch) - 7 Rabbit Patch | Eligible as a contributing resource to the GBO Historic District |
| PH-0929 | Residential | House 8 (Rabbit Patch) - 8 Rabbit Patch | Eligible as a contributing resource to the GBO Historic District |
| PH-0930 | Residential | House 9 (Rabbit Patch) - 9 Rabbit Patch | Eligible as a contributing resource to the GBO Historic District |
| PH-0931 | Residential | House 10 (Rabbit Patch) - 10 Rabbit Patch | Eligible as a contributing resource to the GBO Historic District |
| PH-0932 | Residential | House 11 (Rabbit Patch) - 11 Rabbit Patch | Eligible as a contributing resource to the GBO Historic District |
| PH-0933 | Residential | House 14 - 14 Hannah Run Road | Eligible as a contributing resource to the GBO Historic District |
| PH-0934 | Residential | House 16 - 16 Hannah Run Road | Eligible as a contributing resource to the GBO Historic District |
| PH-0935 | Residential | House 19 - 19 Hannah Run Road | Eligible as a contributing resource to the GBO Historic District |
| PH-0936 | Residential | House 21 - 21 Hannah Run Road | Eligible as a contributing resource to the GBO Historic District |
| PH-0937 | Residential | House 23 - 23 Hannah Run Road | Eligible as a contributing resource to the GBO Historic District |
| PH-0938 | Residential | House No. 24 - 24 Hannah Run Road | Eligible as a contributing resource to the GBO Historic District |
| PH-0939 | Residential | Shinnaberry House - 20 Route 28 | Eligible as a contributing resource to the GBO Historic District |
| PH-0940 | Residential | Nut Bin | Eligible as a contributing resource to the GBO Historic District |

| HPI Site Number | Resource Type | Resource Name | NRHP Status |
|---|---|---|---|
| PH-0331 Updated | Residential | Riley House (15) - 15 Hannah Run Road | Eligible as a contributing resource to the GBO Historic District |
| PH-0941 | Residential | Hill House (17) - 17 Hannah Run Road | Eligible as a contributing resource to the GBO Historic District |
| PH-0942 | Residential | Tracy House (No. 18) - 18 Hannah Run Road | Eligible as a contributing resource to the GBO Historic District |
| PH-0943 | Vacant | Beard House | Eligible as a contributing resource to the GBO Historic District |
| PH-0944 | Residential | Hannah House | Eligible as a contributing resource to the GBO Historic District |
| PH-0945 | Telescope/ Instrument (no longer in active use) | Calibration Horn | Eligible as a contributing resource to the GBO Historic District |
| PH-0946 | Telescope/ Instrument (display) | Karl Guthe Jansky Replica Antenna | Eligible as a contributing resource to the GBO Historic District |
| PH-0947 | Telescope/ Instrument (display) | Ewen-Purcell Horn | Eligible as a contributing resource to the GBO Historic District |
| PH-0948 | Telescope/ Instrument (no longer in active use) | Interferometer Range: Includes Howard E. Tatel (85'-1) Telescope and 85'-1 control building; 85'-2 Telescope; 85'-3 Telescope; and the Interferometer Control Building | Individually eligible under Criterion A; contributes to the GBO Historic District |
| PH-0949 | Telescope/ Instrument | 40-foot Telescope and 40-foot Telescope Control Building | Individually eligible under Criterion A; contributes to the GBO Historic District |
| PH-0950 | Telescope/ Instrument | 140-foot Telescope (43-meter Telescope) | Individually eligible under Criteria A and C; contributes to the GBO Historic District |
| PH-0951 | Telescope/ Instrument | 45-foot Telescope | Eligible as a contributing resource to the GBO Historic District |
| PH-0952 | Telescope/ Instrument | Robert C. Byrd Green Bank Telescope (GBT) | Individually eligible under Criteria A and C and Criterion Consideration G; contributes to the GBO Historic District |
| PH-0953 | Telescope/ Instrument (display) | Reber Radio Telescope | Listed in the NRHP in 1972; named a NHL in 1986; contributes to the GBO Historic District |

GBO = Green Bank Observatory
HPI = Historic Property Inventory
NHL = National Historic Landmark
NRHP = National Register of Historic Places