GROUND WAVE EMERGENCY NETWORK
FINAL OPERATIONAL CAPABILITY

ENVIRONMENTAL ASSESSMENT
FOR
CENTRAL TENNESSEE RELAY NODE

SITE NO. RN 8E911TN

19 February 1993

Electronic Systems Center
Air Force Material Command, USAF
Hanscom AFB, Massachusetts 01731-1623

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THE GROUND WAVE EMERGENCY NETWORK (GWEN) IS a RADIO COMMUNICATION SYSTEM designed TO Relay emergency messages Between Strategic military areas in the continental United states.

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FINDING OF NO SIGNIFICANT IMPACT

NAME OF ACTION: GROUND WAVE EMERGENCY NETWORK
CENTRAL TENNESSEE RELAY NODE

DESCRIPTION OF PROPOSED ACTION ALTERNATIVES:

The U.S. Air Force plans to construct a radio communications relay node in central Tennessee (Coffee or Franklin county) as part of the Ground Wave Emergency Network (GWEN) communications system. Three action alternatives associated with three candidate GWEN sites (CGSs) in central Tennessee and the no action alternative have been considered and evaluated in an environmental assessment (EA).

GWEN is a radio communications system designed to relay emergency messages between strategic military areas in the continental United States. The system is immune to the effects of high-altitude electromagnetic pulse (HEMP) energy surges caused by nuclear detonations in the ionosphere that would disrupt conventional communications equipment. A failure of such equipment would prevent timely communications among top military and civilian leaders and strategic Air Force locations and prevent U.S. assessment and retaliation during an attack. GWEN is an essential part of a defense modernization program to upgrade and improve our nation's communications system, thereby strengthening deterrence.

The GWEN system is a network of relay nodes, receive-only stations, and input/output stations. The relay node in central Tennessee would be part of the Final Operational Capability (FOC) phase of the GWEN system and would establish essential links with adjacent nodes in the network.

In September 1987, the U.S. Air Force Electronic Systems Division, Hanscom Air Force Base, Massachusetts published a Final Environmental Impact Statement (FEIS) for the GWEN FOC that addressed the system as a whole and identified expected environmental effects common to all sites. Section 5 of the FEIS described a siting process that is designed to minimize the potential for environmental impacts. This process has three distinct phases: network definition, regional screening, and individual site evaluation. Network definition identified the need for a relay node in central Tennessee. Regional screening resulted in the identification of three CGSs in central Tennessee that met the exclusionary and evaluative criteria described in that FEIS. Individual site evaluation examined the relative suitability of the CGSs through site-specific technical studies. The EA is a part of the third phase and is tiered from that FEIS. It addresses the potential environmental effects of the three action alternatives and the no action alternative.

The proposed relay node in central Tennessee will be an unmanned facility located on approximately 11 acres of land and, once constructed, will resemble an AM radio broadcast station. The facility will consist of a 299-foot-tall, low-frequency (LF) transmitter tower, three equipment shelters, an access road, and associated fences. The tower will be supported by 24 guy wires, including 12 top-loading elements. An equipment shelter at the tower base will contain an antenna tuning unit. An 8-foot-high chain link fence topped with barbed wire will surround the tower base and associated equipment shelter. A radial ground plane, composed of 100, 0.128-inch-diameter copper wires buried about 12 inches underground, will extend out about 330 feet from the tower base. A 4-foot-high fence will be installed around the perimeter of the copper radials.

A second equipment area located at the site perimeter will contain two shelters housing a back-up power group (BUPG) with two internal fuel storage tanks and radio processing equipment. The BUPG will operate during power outages and for testing purposes. An LF receive antenna, consisting of a pair of 4-foot-diameter rings mounted on a 10-foot pole, and an ultrahigh-frequency (UHF) antenna, used for communicating with airborne input/output terminals and consisting of a 9-foot-high whip-like antenna mounted on a 30-foot-high pole, will also be located in this area. An 8-foot-high chain link fence topped with barbed wire will enclose the entire equipment area. A 10-foot-wide gravel road will connect this area to the tower base. A 12-foot-wide gravel road will provide access to the site from a public road.

The station will use existing commercial three-phase electric power and telephone service. Power and telephone service will be brought to the site through either overhead or buried lines, depending on local utility practices. In its ready status, the antenna will transmit in the LF radio band at 150 to 175 kilohertz for a total of 6 to 8 seconds per hour.

One of the three action alternatives is discussed in this Finding of No Significant Impact (FONSI). Because of significant visual impacts and unknown impacts on historic properties, the Camp Forrest site (CGS-2) will not be considered in this FONSI. Because impacts to surface water and historic properties are unknown, the UTSI Road site (CGS-4) will not be considered.

ANTICIPATED ENVIRONMENTAL EFFECTS

The EA evaluated potential impacts to the physical, biological, and socio-cultural environment from construction and operation of a relay node.

The project would have no significant impacts on physical resources. Erosion and increased runoff would be minimized by using proper erosion control techniques during construction and by replanting the site afterwards. Impacts on mineral resources would be minor. Paleontological resources are not likely to occur on the site; therefore significant impacts to them are not anticipated. No prime farmland would be removed from production. Water quality would not be significantly affected because increases in copper concentrations due to corrosion of the ground plane would be negligible. Air quality would not be significantly affected. During construction, temporary and insignificant increases in emissions would occur, and during operation, emissions from the BUPG would not be sufficient to result in violation of air quality standards.

The project would have no significant impacts on biological resources. The site is located on an agricultural field and does not contain sensitive wildlife habitat. The site does not contain wetlands and is not within a 100-year floodplain. Informal consultation with the U.S. Fish and Wildlife Service indicated that the project would not adversely affect any threatened or endangered species. No state-listed rare, threatened, or endangered species or unique biological communities are listed by the Tennessee Department of Conservation as occurring on the site. Bird-tower collisions may occur but would not be significant because the tower would be located away from primary bird habitats and migration routes.

The project would have no significant impacts on socio-cultural resources. Construction would have a small, beneficial impact on the local economy, in part by providing temporary employment for contractors and construction workers. Community support systems would not be significantly affected. Land use and noise impacts would not be significant. The relay node signal would not interfere with commercial television or radio broadcasts, amateur radio operations, garage door openers, or pacemakers. Radio-frequency emissions outside the fenced area around the tower base would not pose a health hazard to humans or animals. The Tennessee Historical Commission was consulted and concurs that the project would not affect significant cultural resources. Significant impacts to Native American traditional, religious or sacred sites are not anticipated. A visual analysis conducted in accordance with the criteria developed in the FOC FEIS concluded that the relay node facility would not cause significant visual impacts.

CONCLUSIONS:

No significant impacts to the surrounding environment would be caused by construction and operation of the proposed relay node on the Fire Tower site (CGS-3). Therefore, an environmental impact statement for a GWEN relay node at the cited location in central Tennessee is not required.

David O. Williams, Colonel, USAF
Chairman
HQ ESC Environmental Protection Committee

4 Mar 93
Date

PREFERRED GWEN SITE REPORT
CENTRAL TENNESSEE

The U.S. Air Force is proposing to construct a relay node for the Ground Wave Emergency Network (GWEN) in Central Tennessee. The Air Force has followed the siting process described in Section 5 of the Final Environmental Impact Statement (FEIS) for the Final Operational Capability (FOC) phase of the GWEN program to identify alternative Candidate GWEN sites (CGSs). The three CGSs identified in Central Tennessee are referred to as the Camp Forrest, Fire Tower, UTSI sites.

This report summarizes the process of selecting the preferred site from among the three CGSs. This Preferred GWEN Site Report (PGSR), along with a site-specific Environmental Assessment (EA) and Finding of No Significant Impact (FONSI), is being distributed for information and comment in compliance with the Air Force's process of Interagency and Intergovernmental Coordination for Environmental Planning (IICEP).

Operational, environmental, and developmental suitability; construction and real estate acquisition costs; and public comments and concerns are all factors which have been considered in arriving at the selection of the preferred site.

Without an **operationally suitable** location, connectivity of the relay node in Central Tennessee to the GWEN network cannot be achieved. Ground conductivity measurements are acceptable at all three sites. During site-specific studies, no radio frequency interference was detected in GWEN frequency bands which would interfere with the operation of the GWEN receiver. Also, operations at any of the sites would pose no interference with other known systems. UHF line-of-site coverage for a potential airborne interface would be largely uninhibited at either of the three sites. Therefore, all three sites are operationally suitable.

The next major factor considered in selecting the preferred site is **environmental suitability**. The environmental suitability of each CGS was determined from information provided by an independent field analysis and is documented in the EA. The EA for the three CGSs was completed in February 1993. Based on the environmental analysis of each CGS, the Air Force has concluded that no significant environmental impacts would occur at the Fire Tower or UTSI sites. A FONSI for these two sites was completed on 4 March 1993. Significant visual impacts to the town of Tullahoma could occur if the site were constructed on the Camp Forrest site. Therefore, only the Fire Tower and UTSI sites are environmentally suitable.

All three CGSs are **suitable for development** as a GWEN relay node. The FAA has approved construction of the GWEN relay node at either of the three CGSs. **Construction costs** varies dramaticly between the three sites due to the distance to 3-phase power and telephone, and the length of access road required at each individual site. Although, construction costs are lowest at the UTSI and Fire Tower sites, all sites are developmentally acceptable.

The final consideration for selection of the preferred GWEN site is the **real estate acquisition**. Since all three CGSs are located on an Air Force installation, no lease or permits are necessary.

With operational factors acceptable, environmental factors weighed, and developmental factors and acquisition costs considered, the Air Force prefers the Fire Tower site. The Fire Tower site is preferred because it ranks best overall among the

previously mentioned criteria including lowest overall construction and acquisition costs for otherwise qualified sites.

Therefore, I have selected the Fire Tower site as the Air Force's preferred site for development as the GWEN relay node in Central Tennessee. After reviewing the information received during the IICEP process, I will prepare for construction of the relay node.

STEPHEN T. MARTIN, Lt Col, USAF
Program Manager, GWEN

15 March 93
(Date)

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SUMMARY

The Ground Wave Emergency Network (GWEN) is a radio communication system designed to relay emergency messages between strategic military areas in the continental United States. The system is immune to the effects of high-altitude electromagnetic pulse (HEMP) energy surges caused by nuclear bursts in the ionosphere that would disrupt conventional communications equipment such as telephones and shortwave radios. A failure of such equipment would prevent timely communications among top military and civilian leaders and strategic Air Force locations and prevent U.S. assessment and retaliation during an attack. GWEN is an essential part of a defense modernization program to upgrade and improve our nation's communications system, thereby streng.nening deterrence.

The GWEN system consists of a network of relay nodes, receive-only stations, and input/output stations. Each relay node, such as the one proposed in central Tennessee, consists of a guyed radio tower facility similar to those used by commercial AM broadcast transmitters.

A Final Environmental Impact Statement (FEIS) for the GWEN Final Operational Capability (FOC) was published in September 1987 by the Electronic Systems Division, Hanscom Air Force Base, Massachusetts. That FEIS addressed the GWEN system as a whole, identifying expected environmental effects common to all sites. Section 5, beginning on page 5-1 of the FEIS, describes a siting process that is designed to minimize the potential for environmental impacts. This process has three distinct phases: network definition, regional screening, and individual site evaluation.

Phase 1, network definition, identified the geographic coordinates that met the operational needs and technical constraints of the network. Each set of coordinates became the center of a circular site search area (SSA) with a 9-mile radius (250 square miles). The SSA discussed in this Environmental Assessment (EA) was defined by the boundaries of the Arnold Air Force Base (AFB) in central Tennessee, at latitude 35.38° N and longitude 86.09°W. All areas within the boundaries of Arnold AFB were considered, with the exception of the Arnold Engineering Development Center (AEDC), an

aerospace technology research center. The principal communities around Arnold AFB are Tullahoma, Manchester, and Winchester.

Phase 2, regional screening, involved the application of exclusionary and evaluative criteria to the SSA to avoid environmentally sensitive areas. The remaining areas, called potential areawide sites (PAWS), became the focus of the siting process. A field investigation for central Tennessee was conducted in November and December 1989. Eight sites were identified as potential candidate GWEN sites (PCGSs) by applying the site selection criteria of the FEIS including criteria for wildlife refuges, high voltage power lines, 100-year floodplain, railroad tracks, tall metal structures, residential standoffs, recreational standoffs, proximity to three-phase power distribution, and paved roads. Because the SSA is located on U.S. Air Force land, rights-of-entry were not necessary to conduct field investigations. The initial field investigations in November 1989 eliminated four of the eight potential sites due to conflicts with site selection criteria. Further site investigations in December 1989 eliminated one additional site, leaving three candidate GWEN sites (CGSs) for further review. These CGSs were described in the Preliminary Site Evaluation Report (PSER) of December 21, 1989, and are presented in this EA.

Phase 3, individual site evaluation, involves evaluating the relative suitability of the candidate sites through site-specific technical studies. This EA is a product of those evaluations and discusses the three siting alternatives in central Tennessee. It addresses only those criteria that apply to the candidate sites. The fourth alternative, no action, would impair performance of the GWEN system but leave the environment unchanged.

To be suitable for construction and operation, a site should measure at least 700 feet by 700 feet (approximately 11 acres), be relatively level and undeveloped, be free of natural or man-made obstructions, and have soils capable of supporting the relay node structures. The site should be close to all-weather roads, commercial three-phase power, and telephone lines to minimize costs. To operate effectively, the site must be located at least a minimum distance from obstructions that could affect reception and transmission. These include buildings, towers, high-voltage power lines, and other

communications systems or sources of radio-frequency interference. Specific minimum distances depend on height and power levels of identified obstructions or interfering sources.

This EA shows that construction and operation of a GWEN relay node on the Camp Forrest site (CGS-2) would have significant visual impacts, as discussed in Section 4.2 of this EA.

The Camp Forrest site (CGS-2) and the University of Tennessee Space Institute (UTSI) Road site (CGS-4) conflict with Federal Aviation Administration (FAA) flight safety requirements which preclude construction of a tower on these sites. They therefore were not considered for an historic structures survey nor were they cleared for water quality impacts by the Tennessee Division of Water Management. Impacts on historic properties at both sites and water quality impacts at the UTSI Road site, which is within 300 feet of surface water, are therefore unknown.

The project would have no significant impacts if constructed on the Fire Tower site (CGS-3). During the 6-week construction period, the project would cause temporary and insignificant air quality and noise impacts and slight increases in traffic. It would have a small, beneficial impact on the local economy, in part because it would provide temporary employment for contractors and construction workers. If constructed on this site, the project would have no significant impacts on air quality; water quality; land use; mineral resources; known paleontological resources; biological resources, including threatened and endangered species; or cultural resources that are listed, eligible, or potentially eligible for listing on the National Register of Historic Places. In addition, visual impacts would not be significant. Radio-frequency emissions outside the fenced area around the tower base would not pose a health hazard to humans or animals.

1.0 PURPOSE AND NEED FOR ACTION

The proposed action covered by this Environmental Assessment (EA) includes construction and operation of a relay node of the Ground Wave Emergency Network (GWEN) in central Tennessee (see Figure 1.1 of this EA). This relay node will provide essential connections with adjacent nodes in the network. The major features of a GWEN relay node and associated environmental impacts common to all sites are addressed in the Final Environmental Impact Statement (FEIS) for the Final Operational Capability (FOC) phase of GWEN, which was published in September 1987 by the Electronic Systems Division, Hanscom Air Force Base, Massachusetts. This EA is tiered from that FEIS and addresses site-specific conditions at the candidate GWEN sites (CGSs) for this particular site search area (SSA).

The purpose of GWEN is to provide to the President and the National Command Authority a strategic communications network that is immune to the effects of high-altitude electromagnetic pulse (HEMP) and will carry critical attack warning and force execution data. As a result, GWEN will remove any possibility of potential aggressors taking advantage of the electromagnetic pulse generated by a high-altitude nuclear burst. A HEMP surge would disrupt the nation's electric power line transmission capability, cripple electronic devices, and adversely affect skywave communications networks based on conventional electronics. GWEN provides a low-frequency (LF) ground wave communication network that will not be affected by HEMP effects. It thereby strengthens deterrence by removing the option of beginning an attack against the United States by using HEMP effects.

A partial GWEN network, called the Thin Line Connectivity Capability (TLCC), has been completed. It contains 8 input/output stations, 30 receive-only stations, and 54 relay nodes. The TLCC provides a limited level of HEMP-protected communications to strategic forces and the National Command Authority.

The FOC phase of GWEN will add 29 relay nodes. The FOC will allow communication along several routes, thereby enhancing system availability and ensuring that vital communications will be maintained.

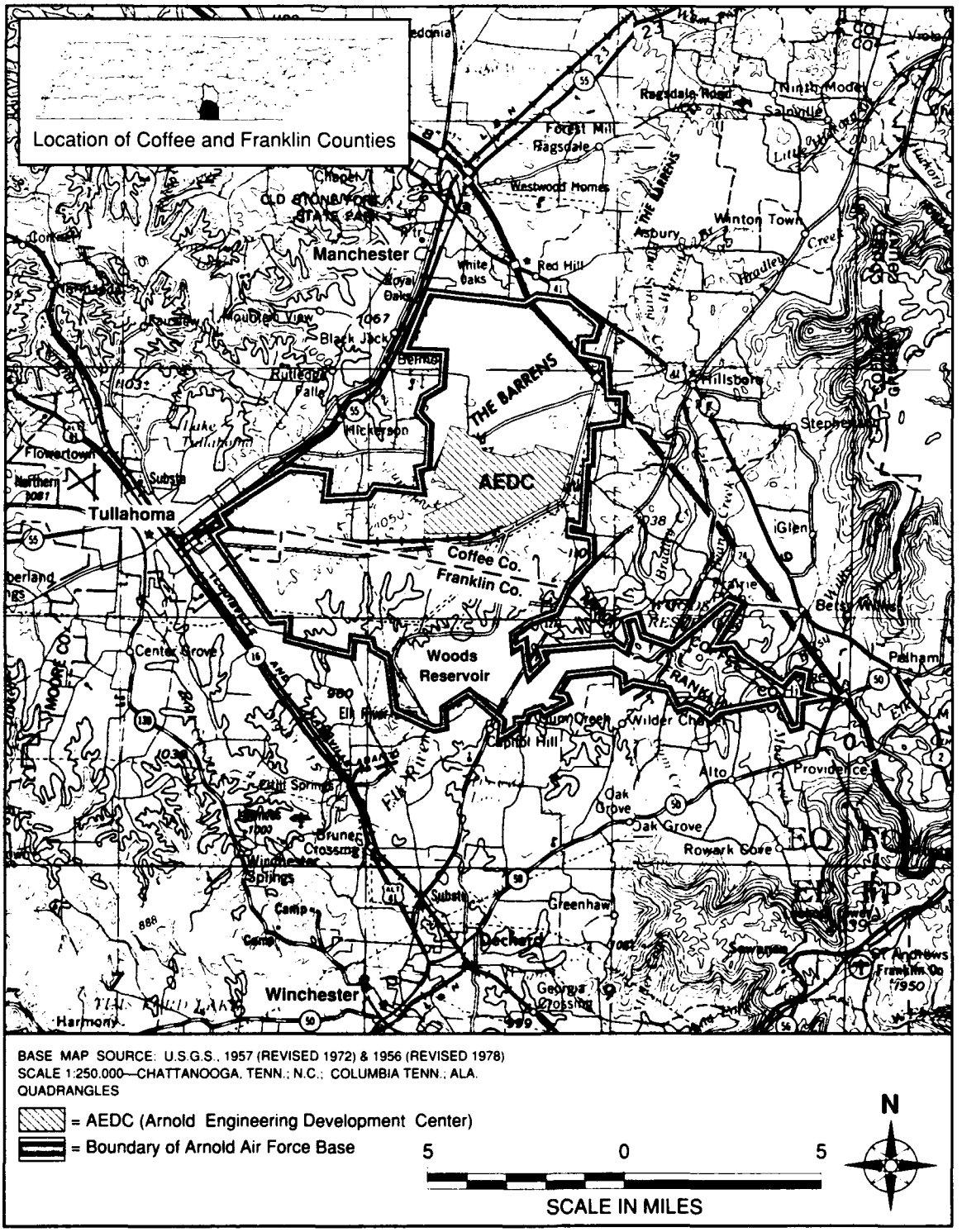

FIGURE 1.1 CENTRAL TENNESSEE SITE SEARCH AREA (SSA), ARNOLD AIR FORCE BASE, COFFEE AND FRANKLIN COUNTIES, TENNESSEE

2.0 ALTERNATIVES INCLUDING THE PROPOSED ACTION

The three action alternatives are site-specific applications of the standard relay node design presented in the FEIS. Consequently, they share a number of features that are discussed in Section 2.1 of this EA. The site-specific features are discussed in Sections 2.2 through 2.4 of this EA. Site descriptive data was obtained during field investigations conducted in November and December of 1989. Figure 2.1 of this EA shows the three CGSs in relation to the major features of the SSA. Figure 2.2 and Appendix B of this EA show the locations of the CGSs in relation to roads and surrounding topography, respectively.

2.1 Common Features of the Action Alternatives

2.1.1 Site Selection Process

The process used to select sites is described in Section 5, beginning on page 5-1 of the FEIS. This process has three distinct phases: network definition, regional screening, and individual site evaluation. Appendix A of this EA provides a diagram of the site selection process. The environmental criteria used in this process are defined in Tables 5-1 and 5-2, pages 5-7 through 5-14 of the FEIS.

Phase 1, network definition, involved locating network nodes to optimize their performance while serving a predetermined number of users. A typical GWEN ground wave has an effective range of about 150 to 200 miles. Thus, relay nodes could not be located independently; changing the location of one would affect the connectivity with other nodes in the network. The SSA was defined by the boundaries of Arnold Air Force Base (AFB).

Phase 2, regional screening, involved the application of exclusionary and evaluative criteria to the SSA to identify areas that might contain operationally acceptable sites outside environmentally sensitive areas. The resulting search areas, called potential

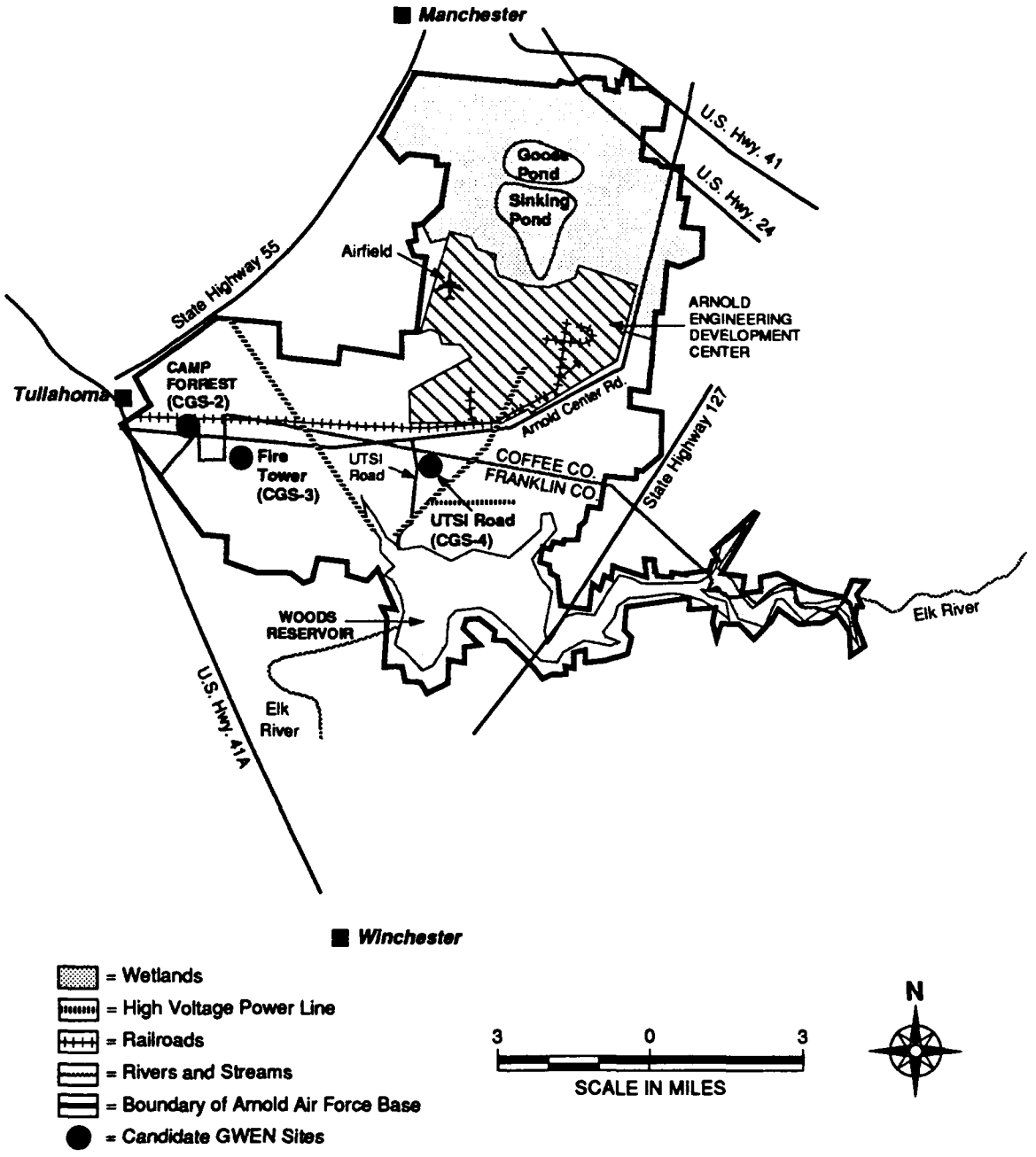

FIGURE 2.1 LOCATIONS OF CANDIDATE GWEN SITES (CGSs) RELATIVE TO SELECTED MAJOR FEATURES AND ROADS WITHIN THE CENTRAL TENNESSEE SITE SEARCH AREA

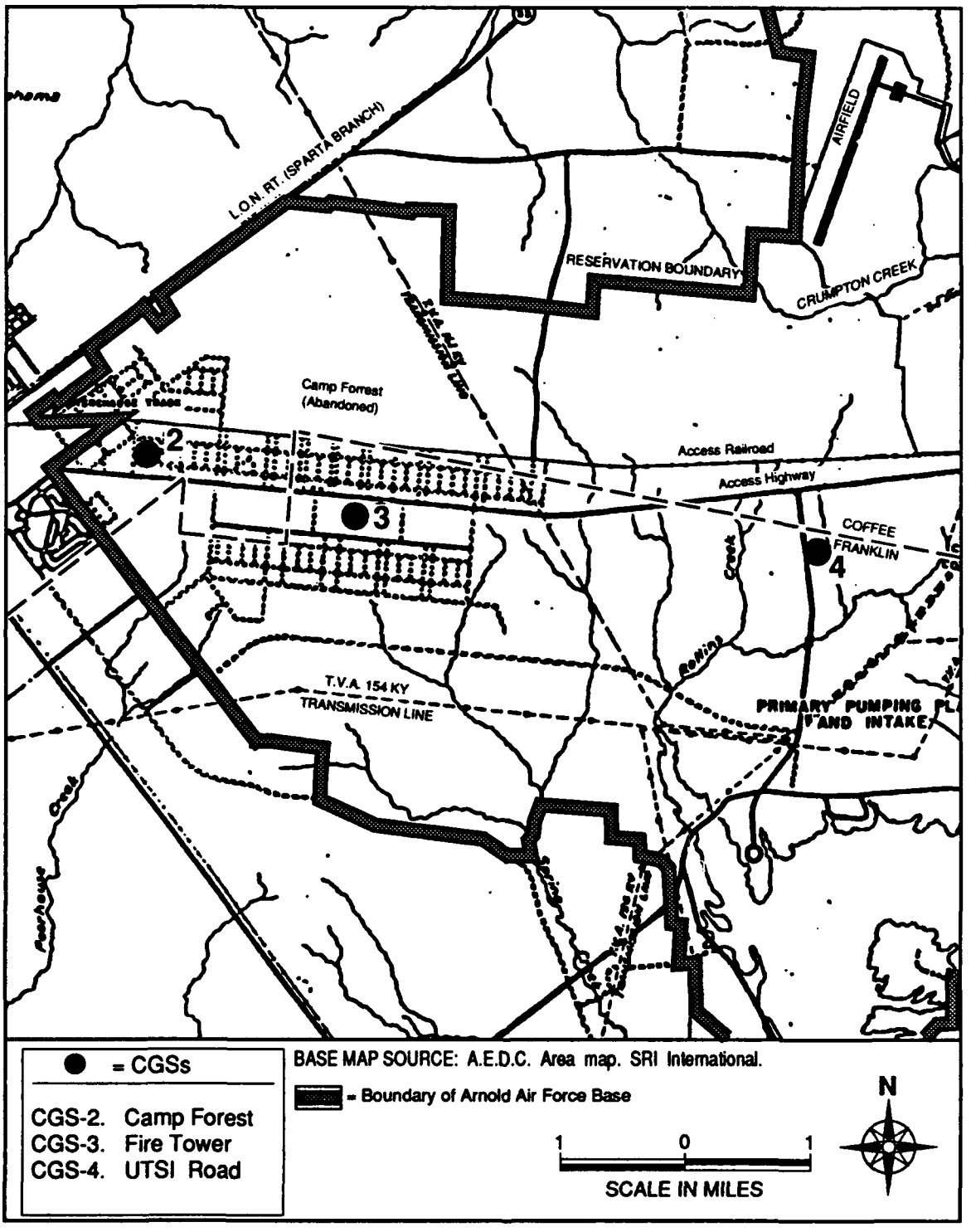

FIGURE 2.2 LOCATIONS OF CANDIDATE GWEN SITES (CGSs) ON ARNOLD AIR FORCE BASE IN COFFEE AND FRANKLIN COUNTIES

areawide sites (PAWS), were submitted to appropriate federal, state, and local officials for review. The PAWS were then redefined, as appropriate, by incorporation of the comments of the reviewers, and a field investigation was conducted to find suitable candidate sites for a GWEN relay node within the redefined PAWS.

The field investigation for central Tennessee was conducted in November and December 1989. Eight sites were identified during automobile-based surveys as potential candidate GWEN sites (PCGSs). Because the SSA is located on Air Force land, rights-of-entry were not necessary to conduct field investigations. Arnold AFB officials eliminated four of the eight sites as being unsuitable. Following evaluation against the environmental criteria set forth in the FEIS, three of the remaining four PCGSs were recommended as CGSs for further review.

Phase 3, individual site evaluation, of which this EA is a part, is then used to determine the relative suitability of the candidate sites through site-specific technical studies. This EA presents the results of the environmental portions of those studies and covers site-specific impacts associated with construction of a relay node in central Tennessee. These are summarized in Sections 4.2 through 4.4 of this EA. The findings of this EA and site-specific studies of operational parameters will be used to select a preferred GWEN site (PGS).

2.1.2 Relay Node Construction and Operation

A typical relay node site is located on approximately 11 acres of land (see Figure 2.3 of this EA). It is an unmanned facility consisting of a 299-foot-tall, three-sided, 2-foot-wide LF transmitter tower, three equipment shelters, an access road, and associated fences. The tower has a base insulator and lightning protection and is supported by 24 guy wires, including 12 top-loading elements to further strengthen the signal and provide additional structural support.

These guy wires and top-loading elements are attached to the tower and to 18 buried concrete anchors. The sizes of these anchors and their depth of burial varies with local soil and bedrock properties. However, the guy-wire anchors typically are rectangular

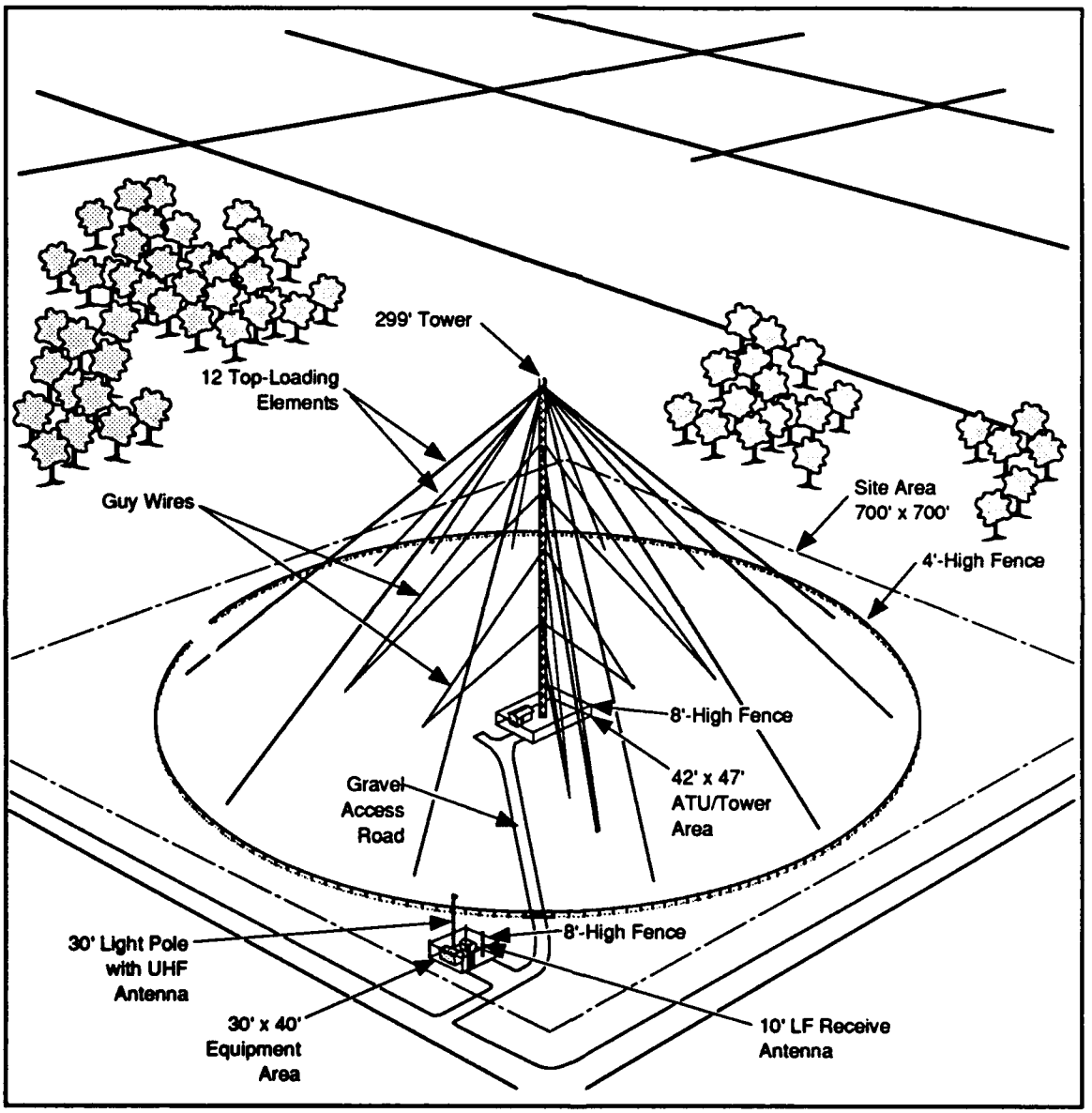

FIGURE 2.3 TYPICAL LAYOUT OF FOC RELAY NODE STATION

blocks buried 5 feet below the surface. If bedrock occurs at or near the surface, the anchors are special rock-embedded rods. The tower base is concrete with a cross-section area resembling an inverted T. The size of this foundation is determined by soil conditions.

A radial ground plane, composed of 100 buried copper wires, extends out from the base of the tower. Each wire is 0.128 inch in diameter, about 330 feet long, and buried approximately 12 inches underground. The ground plane helps to strengthen the broadcast signal, and the number and length of the wires depend on the soil conductivity at the site. A 4-foot-high fence is installed around the perimeter of the ground plane to protect the ground plane and guy anchors and to prevent inadvertent exposure to electric shock resulting from the buildup of static electric charge.

In addition to the main tower, the relay node has two other antennas. One is an LF receive antenna made up of a pair of 4-foot-diameter rings mounted on a 10-foot pole. The second is an ultrahigh-frequency (UHF) antenna used for communicating with airborne input/output terminals. It is a 9-foot-high whip-like antenna mounted on a 30-foot-high pole. Both antennas are located within the equipment area at the perimeter of the site, which is enclosed by an 8-foot-high fence.

The siting and design of the tower are coordinated with the Federal Aviation Administration (FAA) to ensure compliance with FAA standards and regulations. The tower is equipped with a white strobe light at the top, which emits 40 flashes per minute and is rated at 20,000 candelas for daytime and twilight use and 2,000 candelas for nighttime use. To minimize glare at ground level, the light is focused upward and horizontally outward.

GWEN operates intermittently in the LF radio band at 150 to 175 kilohertz (kHz). For comparison, the low end of the AM band for commercial broadcasts is 530 kHz. The peak broadcast power for each GWEN tower is from 2,000 to 3,000 watts, depending on local soil conditions. In its ready status, GWEN typically transmits for a total of 6 to 8 seconds per hour. GWEN does not interfere with commercial television, radio

broadcasts, amateur radio operations, garage door openers, or pacemakers, as noted in Section 2.1.1.1, page 2-3 of the FEIS.

All equipment shelters are anchored to concrete pads. One shelter, located at the base of the tower, houses the antenna tuning unit (ATU). Two other shelters are located side by side in the equipment area enclosed at the perimeter of the property. One houses radio-processing equipment, and the other houses a 70-horsepower, back-up diesel generator and two aboveground fuel tanks. The generator operates 2 hours per week for testing purposes and during power outages. Locked, 8-foot-high chain link fences topped with barbed wire secure the equipment shelter areas at the base of the tower and at the perimeter of the site to provide safety and to inhibit unauthorized entry. A 12-foot-wide gravel road provides access to the equipment area enclosure at the perimeter of the property. A 10-foot-wide gravel road leads from the equipment enclosure to the tower.

Fuel is stored in two aboveground steel tanks inside the generator shelter. Tank capacities are 559 gallons and 461 gallons. Each tank pipes fuel separately to the back-up power group (BUPG) and is equipped with two outlet shut-off valves, one controlled manually and one controlled automatically. If a leak occurs, fuel will flow into a floor drain leading to a tightly capped pipe extending outside the BUPG. Once approximately 2 gallons of fuel accumulate in the pipe, a "liquid spill" signal is sent to the GWEN Maintenance Notification Center, which will dispatch maintenance personnel. However, if a leak were not detected, an explosion inside the shelter would be extremely unlikely due to the high flash point of diesel fuel. If a tank at the GWEN station failed, the entire contents of one tank could be released and contained inside the BUPG shelter. Refer to Section 4.12.1.1, beginning on page 4.12-1 of the FEIS for further discussion on diesel fuel spills and leaks.

The station uses existing commercial three-phase electric power and telephone service, but does not require water, septic, or sewer systems. Power and telephone service are brought to the site through either overhead or buried lines depending on local utility practices. Power and telephone service are generally brought underground from the site boundary to the equipment shelter area.

Temporary increases in air pollutant emissions will occur during construction, primarily from greater use of heavy machinery than is required in normal farming operations. Emissions resulting from operations of the facility will be limited to the operation of the BUPG, which will operate only 2 hours every week for testing purposes and for additional periods as required during power outages. Thus, the generator will operate for a total of 152 hours per year, if commercial power outages totaled 48 hours. If the generator runs at 100 percent load during the projected 152-hour operating time, total emissions in one year will be less than 350 pounds per pollutant, as documented in Section 4.3.1, beginning on page 4.3-1 of the FEIS.

Noise levels generated by construction equipment are discussed in Section 4.5.1.1, beginning on page 4.5-1 of the FEIS. Under worst-case assumptions, levels could reach 78 dBA at the site boundary from on-site activity and 92 dBA at distances of 50 feet from equipment installing the off-site access road. Noise generated during GWEN operation would come from the BUPG, which will operate only 2 hours per week and during commercial power outages. The BUPG will be located at least 50 feet within the site boundary with its exhaust side oriented toward the tower area. Noise levels due to intermittent operation of the BUPG will be less than 72 dBA at the site boundary, which is within the standards typically set for lands under agricultural use (70 to 75 dBA). At 50 feet beyond the site boundary, the noise level would drop below 65 dBA, which is within the standards typically set for residential and mixed residential/agricultural use (55 to 65 dBA). These noise levels and standards are discussed in Section 3.5.3, page 3.5-2 and Section 4.5.1, pages 4.5-1 through 4.5-6 of the FEIS.

Construction will require as many as 20 workers at any given time and take about 6 weeks. Standard earth-moving and erection equipment will be used, as detailed in Table 2-1, page 2-14 of the FEIS. Erosion control techniques that are consistent with local practices will be used during construction. For the Camp Forrest site (CGS-2), approximately 10 acres of trees will be removed. For the Fire Tower site (CGS-3), vegetation removal and grading will be minimal. For the University of Tennessee Space Institute (UTSI) Road site (CGS-4), 1 acre of trees and brush will be removed. All sites will be replanted after construction is finished.

After construction is completed, personnel requirements will be limited to periodic maintenance by a contractor who will service the equipment, cut the surface growth, and perform other services, as needed. Security services will be met by Arnold AFB security personnel. The projected life of the facility is 15 to 25 years. Upon decommissioning, the tower and other structures will be removed, as discussed in Section 2.1.4, page 2-18 of the FEIS.

2.2 Alternative 1: Camp Forrest Site (CGS-2)

The site is located in the old Camp Forrest area in the western portion of Arnold AFB, approximately 0.6 mile from the nearest residential area of Tullahoma. The property lies 433 feet north of Arnold Center Road, a paved, Air Force-maintained road that serves as Arnold AFB's main east-to-west route. An existing paved 20- to 25-foot-wide road would provide access to the site from Arnold Center Road.

Three-phase power would be obtained from overhead lines approximately 3,073 feet west of the site. This would require 480 feet of new three-phase power construction; the remaining 2,640 feet would be upgraded from two-phase power. Telephone lines would be connected to an underground cable along Arnold Center Road, approximately 430 feet south of the site.

Appendix B, Figure B-1 of this EA, provides a map showing the surrounding topography.

2.3 Alternative 2: Fire Tower Site (CGS-3)

The site is an 11-acre tract within a 40- to 50-acre rectangular open parcel in the western portion of Arnold AFB. The site is 187 feet south of Arnold Center Road, approximately 2.2 miles east of the city of Tullahoma, and 3.6 miles west of the UTSI Road.

The GWEN tower would be located directly south of an existing 80-foot-tall metal fire lookout tower that stands on the north central edge of the parcel. Access would be from an existing 187-foot dirt road, which would require upgrading.

Three-phase power would be obtained from overhead lines approximately 2.2 miles west of the site. This would require upgrading of 0.9 mile of existing two-phase power and construction of the remaining 1.3 miles of three-phase power. Telephone lines would be connected to an underground cable running along the north side of Arnold Center Road, approximately 210 feet north of the site.

Appendix B, Figure B-2 of this EA, provides a map showing the surrounding topography.

2.4 Alternative 3: UTSI Road Site (CGS-4)

The site is in the central portion of Arnold AFB, approximately 4.5 miles east of Tullahoma on the east side of the UTSI Road and about 0.5 mile south of Arnold Center Road. Access would be from the paved UTSI Road and would require an access road 29 feet in length.

The northeast quadrant of the site has a tall, thin tree line approximately 300 feet long and 50 feet wide. These trees would be removed to accommodate the GWEN tower.

Three-phase power would be obtained from overhead lines at a substation approximately 1.8 miles south of the site. This would require upgrading 0.7 mile of one-phase power and construction of the remaining 1.1 miles of three-phase power. Telephone lines would be connected to an underground cable along the east side of the UTSI Road, adjacent to the site.

Appendix B, Figure B-3 of this EA, provides a map showing the surrounding topography.

2.5 No Action Alternative

The no action alternative is deletion of the central Tennessee relay node from the GWEN network. Adoption of this alternative would mean a consequent degradation in the performance of the system due to a lack of connectivity to other nodes in the system.

3.0 AFFECTED ENVIRONMENT

This section discusses the environmental setting of the proposed GWEN project in central Tennessee. Section 3.1 of this EA describes the general characteristics of the SSA, and Sections 3.2 through 3.4 of this EA describe the unique characteristics of each CGS within the SSA. Site descriptive data was obtained during field investigations conducted in November and December of 1989. U.S. Geological Survey 7.5 minute topographical maps were used as data sources for distances, physiographic features, and topography (USGS, 1972a-b, 1976, 1982a-b, and 1983a-b).

3.1 Site Search Area

Presented below is information on the physical, biological, and socio-cultural settings of the SSA.

3.1.1 Physical Setting

The SSA is defined by the boundaries of the 40,000-acre Arnold AFB in Coffee and Franklin counties in the Appalachian Highlands physiographic province of the United States.

Arnold AFB is in the western portion of the Appalachian Highlands physiographic province in an area known as the Eastern Highland Rim. It is a plateau intermediate in elevation between the Cumberland Plateau to the east and the Central Nashville Basin to the west. The land is generally flat with areas of gently rolling hills, though the southern part of Arnold AFB, near Woods Reservoir, has steep slopes of 10 percent or greater.

Geologically, Arnold AFB is characterized by relatively flat-lying sedimentary rocks dating to the Permian, Pennsylvanian, and Mississippian periods, approximately 225 million to 350 million years ago. The sedimentary rocks range from a few hundred to a few thousand feet thick (USGS, 1970) and consist of flat-lying beds of limestone and dolomite, with some coal, shale, sandstone, and chert (a fine-grained flint-like siliceous

rock). Bedrock generally is buried by 2 to 86 feet of soil and weathered rock and is rarely exposed (SCS, 1958).

Seismic activity in the area has been relatively low in historic times. The two earthquakes closest to Arnold AFB were centered 12 miles to the north and had a Modified Mercalli (MM) intensity of III. In addition, a 1921 earthquake with an MM intensity of III and a 1956 quake with an MM intensity of IV had epicenters within 20 miles of Arnold AFB. In 1982, an earthquake with an epicenter about 40 miles south of Arnold AFB had an MM intensity of V. Earthquakes of MM intensity V or less are noticeable but are not strong enough to cause substantial damage (Howard *et al.*, 1979; Reagor *et al,*. 1987; Stover, 1986). The level of seismic hazard in the SSA is low. Small earthquakes could occur but are unlikely to cause significant property damage to well-constructed structures (Manitakos, 1989).

No significant mineral resources of commercial value exist on Arnold AFB. Chert has some economic value but the local supply is buried too deeply to be profitable and no quarries are within the Arnold AFB boundaries (TBG, 1989).

No fossils or paleontological resources have been found on Arnold AFB, and no such resources are expected to be uncovered during GWEN construction (Dunne, 1989).

Modern soil over much of Arnold AFB is primarily composed of residual material from weathered limestone. Clay is a common secondary soil component in central Tennessee, as are concentrations of silt, sand, chert, and shale (TBG, 1989). Dickson silt loam, the predominant soil on the CGSs, is common in both Coffee and Franklin counties and is formed from silt and cherty limestone. It is generally free of rocks and is moderately acidic to very strongly acidic, pH 6.0 to 4.5, with slight to moderate erosion potential. Drainage from this soil is moderate to somewhat poor, and the depth to the seasonally high water table is 2 feet or less because Dickson silt loam typically has a fragipan or claypan composition—a dense, compact layer that restricts root growth, slows permeability, and limits soil absorption of water during heavy rainfall (SCS, 1958). A total of 1,916 acres on Arnold AFB is used for agricultural fields; 1,771 of these acres

are classified as prime farmland. None of the CGSs is on prime farmland (TBG, 1989), and none has soils that are hydric (SCS, 1987).

Woods Reservoir on the southern boundary is the largest body of water on Arnold AFB and was created by damming the Elk River, which enters the reservoir from the northeast. The other major waterway in the vicinity is Duck River, 2 miles north of Arnold AFB, near the town of Manchester. Both the Elk and Duck rivers flow southwest for some 85 miles to join the Tennessee River (TBG, 1989). Other significant surface water on Arnold AFB is the wetlands area in the north, which contains virgin swampland protected as a wildlife management area. Goose Pond, a 158-acre natural marsh, and Sinking Pond, a 150- to 200-acre virgin swamp forest, are part of these wetlands.

All rainfall on Arnold AFB enters either the Duck River drainage basin to the northwest, or the Elk River basin to the south. Two creeks, Crumpton and Wiley, drain into the Duck River, and Crumpton Creek receives drainage from the Sinking Pond wetlands. Brumalow and Rollins creeks also cut through Arnold AFB but drain into the Elk River and Woods Reservoir. The Fire Tower (CGS-3) and UTSI Road (CGS-4) sites are within 300 feet of surface water. Details of the distances from each CGS to the nearest surface water or wetlands are given in Sections 3.2 through 3.4 of this EA.

Water resources at Arnold AFB come from a double-layered aquifer system. A shallow aquifer, composed of alluvial silt and sand deposits, discharges primarily into the area's reservoir, ponds, and streams. A second, deeper aquifer below the shallow aquifer is underlain by layers of relatively impermeable Chattanooga shale composed mostly of clay and chert rubble. Whereas the groundwater flow of the shallow aquifer generally follows the contour of the land, the deeper aquifer's flow is relatively undefined. Groundwater supplies some of Arnold AFB's public water needs through a system of wells located near Woods Reservoir; other water sources are the Estill Springs Water District and Woods Reservoir (TBG, 1989).

Groundwater quality in and around Arnold AFB is generally characterized as good. However, no base-wide system exists for monitoring groundwater quality and there are few available wells from which to take accurate samples. The results of a 1984 water

quality study were questionable, because the samples were from wells drilled at different times for different purposes; well samples included a shallow network that monitored groundwater at approximately 30- to 40-foot depths and a network that monitored supplies at approximately 50- to 60-foot depths. Although survey results identified several areas of groundwater contamination, only a fraction of the total aquifer volume was affected, and the drinking water wells on the Arnold Engineering Development Center (AEDC), a portion of Arnold AFB, showed no adverse effects (TBG, 1989).

None of the CGSs lies in a 100-year floodplain (FEMA, 1978).

The climate of south central Tennessee is warm, temperate, and humid, with hot summers (averaging 76°F) and mild winters (averaging 42°F and falling below 0°F only about once a year). Strong winds are uncommon except in early spring. Summer weather is usually calm, with temperatures reaching as high as 95°F during the prolonged hot spells of July and August. Winter weather is usually mild enough for outdoor work, although northerly winds are common and temperatures can change abruptly. Snow falls two to five times annually but rarely accumulates to more than 6 inches and usually melts in a day or two. The heaviest rains come in winter and spring. Average annual precipitation is 54 inches. Winter rains are usually heavy and accelerate erosion in soils unprotected by vegetation. Fall is the driest season (SCS, 1958).

Air quality is good and does not exceed the National Primary or Secondary Ambient Air Quality Standards, which have been adopted by the State of Tennessee (Waynick, 1989). According to the Tennessee Department of Health and Environment, Franklin and Coffee counties have achieved a level of air quality attainment and are not subject to any restrictive air quality measures (TBG, 1989). Air quality standards are discussed in Section 3.3.3, pages 3.3-1 through 3.3-7 of the FEIS.

3.1.2 Biological Setting

The natural tree stands of central Tennessee consist primarily of mature hickory-oak forest, as well as red, white, and scarlet oak (NFS, 1977). Black gum, sweet gum, and

maple are also fairly common throughout the region. Loblolly, Virginia, and white pine, though not native to central Tennessee, were introduced in the early 1950s and have grown quite successfully. Arnold AFB planted approximately 4,500 acres of pine as part of a program to abate the sound generated by test operations (TBG, 1989).

Goose Pond, a marsh, has a forest cover of red maple and sweet gum and a shrub layer of ferns and grasses. The Sinking Pond marshland has primarily willow oak and red maple. Other undeveloped areas of Arnold AFB have mature oak and pine forest with some meadows and wetlands. Forested lands typically have thick growth with stand heights of 50 to 60 feet. Ground cover in unwooded areas includes a variety of grasses—Bermuda, rye, crab, goose, Kentucky blue, and Kentucky fescue—as well as weeds, especially chickweed and white dutch clover (TBG, 1989).

Common animals in the area include white-tailed deer, gray and fox squirrel, raccoon, opossum, cottontail rabbit, eastern chipmunk, red and gray fox, shrew, muskrat, weasel, bobcat, and coyote. The most common fish are catfish, bass, sunfish, bluegill, white crappie, and walleye. Waterfowl such as the Canada and snow goose, mallard, wood duck, teal, and coot are present. Quail, grouse, snipe, woodcock, turkey, horned grebe, great blue heron, cattle egret, turkey vulture, various species of hawk and owl, and numerous songbirds are also common (TBG, 1989).

The *Federal Manual for Identifying and Delineating Jurisdictional Wetlands* (GPO 1989-236-985/00336) states that an area must meet three criteria to be designated as wetland: hydric soils; hydrophytic vegetation; and wetlands hydrology, which includes a shallow water table and standing water for at least 7 days of the growing season (FICWD, 1989). This manual was used as the basis for wetland determination. Based on field investigations (Kroupa, 1989) and soils data (SCS, 1958, 1987; TBG, 1989), none of the CGSs examined as part of this EA meets these three criteria, nor do the areas within 300 feet of the CGSs.

In 1954 the Arnold Center Wildlife Management Area was established as part of a joint Air Force/Tennessee Fish and Game Commission plan to encourage and increase the fish and wildlife populations by promoting soil improvements, water control, and other

conservation practices. Presently some 2,000 acres have been leased to local farmers under this plan and approximately 5 percent of the crops cultivated are left in the fields to provide food and ground cover for wildlife. Funds received by the Tennessee Wildlife Resource Agency from leased land are used to help support state fish and game programs. Arnold AFB now has 32,300 acres suitable for wildlife habitat and 3,980 acres at Woods Reservoir suitable for fish. None of the CGSs analyzed in this EA is in a designated wildlife area (TBG, 1989).

Marsh and swampland areas of Arnold AFB are in the northern and southeastern portions. Two of these areas in the north, Goose Pond and Sinking Pond, have special botanical interest and the U.S. Fish and Wildlife Service (USFWS) has selected them as Registered Natural Landmarks (TBG, 1989).

In compliance with Section 7 of the Endangered Species Act as amended (16 United States Code [USC] 1531, *et seq.*, at 1536), a list of threatened and endangered species was requested during informal consultation with the USFWS. In 1990, no threatened or endangered species were identified by the USFWS as being in the project impact area (Appendix C, Winford, 1990, page C-4 of this EA). Further consultation with the USFWS in 1992 and 1993 established that two new endangered plant species had been added to the list and could occur in the project area: the leafy prairie clover (*Dalea foliosa*) and the Tennessee yellow-eyed grass (*Xyris tennesseensis*) (Appendix C, Barclay, 1992, 1993 pages C-9, C-10, and C-12 of this EA).

The leafy prairie clover is a species of rocky hills, glades, and riverbanks (Fernald, 1950). The USFWS confirmed that the habitat of this clover is rocky sites (Widlak, 1992). The Tennessee yellow-eyed grass, like the other species of this genus that occur in the eastern United States, is a species of moist habitats. It is found at seeps, springs, gravelly banks of small streams, and on moist slopes near seeps and springs (Widlak, 1992).

State-listed species that might occur in the project area include eight threatened or endangered animal species and more than two dozen rare or endangered plant species. The endangered species include the osprey (*Pandion haliaetus*), Bachman's sparrow

(*Amophila aestivalis*), and the barrens topminnow (*Fundulus species*). The threatened species include the northern pine snake (*Pituophis melanoleucus*), Bewick's wren (*Thryomanes Bewickii*), Cooper's hawk (*Accipiter cooperii*), the grasshopper sparrow (*Ammodramus savannarum*), and the sharp-shinned hawk (*Accipiter striatus*). The listed birds have a "probable or seasonal" occurrence in the area, primarily in the wetlands in the northern portion of Arnold AFB and in the vicinity of Woods Reservoir. Most of the listed plant species are indigenous wetland vegetation. Sinking Pond has eight types of protected vegetation; Goose Pond nas eleven (TBG, 1989).

3.1.3 Socio-Cultural Setting

Excavations in the Duck River Valley in Coffee County have produced artifacts that date as far back as the Late Archaic Period, 2,500 to 1,000 years B.C., indicating that humans have occupied the region of Arnold AFB for more than 4,000 years (DuVall, 1990).

Native American inhabitants of central Tennessee in the late 1700s were the Shawnee and Yuchi tribes; the Chickasaws occupied areas to the south and the Cherokees to the east. Increasing pressure from Euro-American settlers eventually pushed these tribes westward, and by 1805 much of the territory was carved up for permanent settlement. The first Euro-American settlements in what is now Franklin County were at Rolling Fork, near Cowan, and along Beans Creek. Itinerant frontiersmen from North Carolina, Virginia, and Georgia were among the first immigrants. Other settlers received homestead warrants for service in the Revolutionary War and came to begin a life of farming. By 1820 the Nickajake Trail had been upgraded to become Unicoi Road, the region's main turnpike and the route connecting Nashville, Tennessee, to Augusta, Georgia (Billington, 1956). In the early 1800s the new railroad further increased expansion and development in the area. The Tennessee Legislature created Franklin County on December 3, 1807, and later part of the original county became Moore, Coffee, Grundy, and Marion counties (SCS, 1958).

Arnold AFB was established in 1951. The State of Tennessee donated 33,000 acres to the United States Air Force and an additional 7,000 acres were purchased from the local

community. Much of the donated area was Camp Forrest, a World War II training facility; the remaining land was agricultural or forest land (Dunne, 1990).

The Tennessee State Historic Preservation Officer (SHPO) was consulted, as required by the National Historic Preservation Act (16 USC 470, *et seq.*). Because of the area's prehistoric activity, the Tennessee SHPO recommended that a Phase I archaeological survey of the CGSs be conducted to identify archaeological resources (Appendix C, Harper, 1990, page C-5 of this EA). In March 1990, a professional archaeologist qualified in the State of Tennessee, surveyed each site using pedestrian transects at 5-meter intervals. No significant archaeological resources were found on the sites (DuVall, 1990). The Archaeological Division of the Tennessee Department of Conservation has information on five previously recorded prehistoric archaeological sites on Arnold AFB. Local collectors found all of these sites along the Elk River, more than 10 miles from the CGSs (TBG, 1989).

For reasons discussed in Section 4.8.1.3, beginning on page 4.8-2 of the FEIS and Section 4.1.3 of this EA, historic properties that occur within 1.5 miles of a CGS are potentially subject to adverse visual impacts from the relay node facility. No properties on Arnold AFB are listed or eligible for listing on the National Register of Historic Places (NRHP, 1988). Further investigation confirmed that there are no historically significant properties within 1.5 miles of the Fire Tower (CGS-3) site (Appendix C, Hiebert, 1990, page C-8 of this EA). The Tennessee SHPO concurred that construction at the Fire Tower site will not affect properties which have been determined eligible for the NRHP (Appendix C, Harper, 1990, page C-7 of this EA). A historic structures survey was not conducted for the Camp Forrest (CGS-2) and UTSI Road (CGS-4) sites because of conflicts with the FAA which preclude construction on these sites.

In compliance with the American Indian Religious Freedom Act of 1978 (42 USC 1996), the Bureau of Indian Affairs (BIA) was consulted in order to locate tribes associated with the project area. The BIA indicated that no federally recognized tribes currently live in Tennessee. The only federally recognized tribe that was historically in the area is the Shawnee (Sutherland, 1992). Based on BIA recommendations, the Absentee-Shawnee Executive Committee in Oklahoma and the Eastern Shawnee Tribe of Oklahoma were

notified of the GWEN project and information was requested regarding traditional, religious, or sacred sites within the SSA. A representative of the Eastern Shawnee Tribe of Oklahoma stated that the tribe has no concerns with the GWEN project in central Tennessee (Howser, 1992). No response has been received to letters or several attempts at phone communication from the Absentee-Shawnee Executive Committee in Oklahoma. Information was also requested from the Tennessee Commission on Indian Affairs. The Commission indicated that no traditional, religious, or sacred sites exist on any CGS (Butler, 1990).

Development on Arnold AFB, associated primarily with the AEDC, an aerospace technology research center, is clustered in the flat central portion identified on geological survey maps as "The Barrens." Many buildings, including a lookout tower, water tank, electrical substation, water filtration plant, and office and administrative buildings, are within the AEDC compound. Development in the remaining area is limited to officers quarters, recreation facilities, parks, camps, and the UTSI, all near Woods Reservoir.

Land use on Arnold AFB is primarily related to Air Force activities; however, portions of the land have been leased to local farmers through the Tennessee Fish and Game Commission to improve the soil and to increase wildlife habitats. This acreage is planted with corn, soybeans, buckwheat, and millet.

The major road within Arnold AFB is Arnold Center Road, which connects with U.S. Highway 41A at Tullahoma to the west, crosses the center of Arnold AFB, then turns northeast to tie into U.S. Highways 24 and 41 in the northeast portion. The UTSI Road runs north-south between Arnold Center Road and Woods Reservoir. Several secondary roads branch off from the main roads and provide access to more remote areas of Arnold AFB. The Air Force maintains the roads.

The AEDC access railroad tracks parallel Arnold Center Road and end at the office and administrative compound. These tracks tie into the Louisville and Nashville Railroad system in Tullahoma. Arnold Airfield to the west of the administrative compound is primarily used to test experimental jet aircraft but also allows for the transportation of equipment and personnel.

Ambient noise levels are an important element of Arnold AFB/AEDC operations, because of the airport and rocket engine-testing facilities. However, noise generated by testing is not considered significant outside of the testing facilities, because it does not exceed Occupational Safety and Health Administration (OSHA) established standards. Arnold AFB is exempt from Air Installation Compatible Use Zone regulations because of the low volume of air traffic and the distance from sizeable population and business centers. The operations at Arnold AFB are not currently affected by any state, local, or Environmental Protection Agency (EPA) noise regulations or restrictions (TBG, 1989).

The populations of Coffee and Franklin counties in 1986 were 41,300 and 33,700, respectively, with a 6 percent increase since 1980 (Census Bureau, 1988a). This population is concentrated in the communities of Tullahoma, Manchester, Estill Springs, Winchester, Monteagle, Cowan, Normandy, Sewanee, and Decherd. The majority of AEDC personnel resides within 10 miles of Arnold AFB boundaries and is heavily concentrated in the cities of Tullahoma, Manchester, and Winchester (TBG, 1989). *Tullahoma and Manchester are the two largest population concentrations with 16,780* and 7,630, respectively, in 1986 (Census Bureau, 1988a).

Per capita income for the combined areas of Coffee and Franklin counties equaled $8,695 in 1985, below the state figure of $9,290 and the national figure of $10,800. In 1986, 8.4 percent of the salaried labor force from the area was unemployed, slightly higher than the statewide figure of 8 percent and the national figure of 7 percent. In 1982, close to 50 percent of the combined land area of both counties was used for agricultural farming (Census Bureau, 1988b).

The economies of Coffee and Franklin counties are closely related to the performance of Arnold AFB. As the area's primary employer, Arnold AFB's annual payroll totaled $150 million in 1988 (TBG, 1989). Manufacturing is the region's second largest source of employment. Tullahoma, for example, is home to the Cleveland Pneumatic Company, the Tennessee Apparel Corporation, the Wilson Sporting Goods Company, the Coca Cola and Dr. Pepper Bottling Company, and the Lannom Manufacturing Company.

Manchester manufacturers include the Batesville Casket Company, PCA Apparel Industries, Eden Industries, and Parks Industries (TBG, 1989).

Recreational resources within Arnold AFB are primarily concentrated in the Woods Reservoir area. Fishing and water sports are popular activities among both Air Force personnel and the local civilian population. The reservoir is accessible to the general public. The south shore has numerous picnicking facilities as well as one county-managed camping facility. Arnold AFB's recreational facilities are generally limited to base personnel and include a golf course, hiking trails, and model airplane field, all located off Arnold Center Road just east of Tullahoma.

Old Stone Fort State Park and Lake Normandy are 7 miles northwest of Arnold AFB. Tim's Ford State Park and Lake are approximately 7 miles southwest. Both of these facilities allow for camping, hiking, and water sports.

The visual setting is rural in character. Except for the hilly area around Woods Reservoir, the topography of Arnold AFB is fairly level and the landscape offers no noticeable visual pattern. Much of the land is forested with tall pine and oak stands which act as barriers to views from outside Arnold AFB. Vacant barracks, industrial facilities, water towers, the fire lookout tower, high-power transmission lines, and radio antennas are concentrated along either the Arnold Center Road or the UTSI Road. Depending on the direction of view, the complexity of the skyline varies from low to high, as defined in Section 4.8.1.3, page 4.8-10 of the FEIS.

3.2 Alternative 1: Camp Forrest Site (CGS-2)

The site is part of the old Camp Forrest, which was a U.S. Army training facility during the 1930s and 1940s (Dunne, 1990). Virtually none of the original structures in the area is still standing; however, many of the original paved and gravel roadways remain, creating a cross-hatching configuration. An industrial area is currently operative northwest of the site and contains a 100-foot-tall metal water storage tank that stands approximately 1,750 feet from the site.

The site is on level ground with 0 to 1 percent slope. It has been planted with pine trees within the past five years. These trees, along with other vegetation, have heights of 1 to 8 feet. The site is screened on all four sides by mature pine forest with stands reaching heights of 50 to 60 feet. No rare or old growth vegetation is present.

The nearest surface water is 0.3 mile northeast of the site. No soil erosion, collapse, or settlement was observed during the on-site investigation.

The presence of potentially eligible historic properties within 1.5 miles of this site is unknown. Since the site has conflicts with the FAA which preclude construction of a tower on this site, a survey to identify potentially eligible properties was not conducted.

The closest community is Tullahoma, with its nearest residential area located approximately 0.6 mile southwest of the site.

3.3 Alternative 2: Fire Tower Site (CGS-3)

The site is part of a parcel leased by the Air Force to local farmers through the Tennessee Fish and Game Commission under the Wildlife Management Plan (Dunne, 1989). Corn rows are planted in swirls around the clusters of trees and shrubs that dot the field, and the surrounding vegetation is thick pine forest and brush.

The site, located in the center of the leased field, is fairly level, though a slight downward slope to the east provides natural drainage. The nearest surface water is a small seasonal pond, surrounded by a cluster of trees, located 200 feet from the eastern boundary. The pond, approximately 1 foot deep and 10 feet in diameter, appears to collect rainwater from about a 100-yard radius around the site but does not support vegetation or aquatic life. A dry streambed slopes downward from the pond toward the southeastern corner of the field, handling pond overflow during heavy rains. According to USGS topographical maps, the stream is a tributary of Spring Creek, which is more than 2.5 miles southeast of the CGS.

There are no NRHP-listed or eligible properties within 1.5 miles of this site (NRHP, 1988; Appendix C, Hiebert, 1990, page C-8 of this EA).

The closest residential community is Tullahoma, 2.2 miles to the west.

3.4 Alternative 3: UTSI Road Site (CGS-4)

This site occupies roughly half of a parcel of cleared forest. The terrain is fairly level with a high point in the center of the site, at the proposed tower base. The slope from the center is toward the east, the lowest point being on the northeastern corner.

Surrounded by thick, mature pine forest on all sides with a meadow extending from the southeastern corner, the site was cleared some years ago and contains the remains of downed trees and overgrown shrubbery. In the site-clearing process, power saws were used to cut the trees at ground level and the stumps and root systems were never removed. Many of these stumps have rotted, are brittle, and would have to be removed to accommodate the ground plane.

Although the CGS has no surface water, an intermittent stream runs through the trees adjacent to the northern and eastern boundaries. The stream crosses under the UTSI Road roughly 60 feet from the site's northern boundary and continues to the northeastern corner where, at the time of the field investigation, it formed an area of standing water approximately 100 feet from the corner of the site. The depth of the standing water did not exceed 3 inches and its surface level was 4 feet below the elevation of the proposed tower base. The stream makes a 90-degree turn and flows along the eastern edge of the site, approximately 100 feet from the boundary line. According to the USGS topographical map, the stream then flows toward the southwest for 1.25 miles and enters Rollins Creek 2 miles upstream from Woods Reservoir. Despite the presence of standing water, the soils within 300 feet of the site are not hydric soils, and no hydrophytic vegetation was observed within 300 feet of the site (Kroupa, 1989). Consequently, no wetlands are present on or within 300 feet of the site.

The presence of potentially eligible historic properties within 1.5 miles of this site is unknown. Since the site has conflicts with FAA flight safety requirements which preclude construction of a tower on this site, a survey to identify potentially eligible properties was not conducted.

The closest residential community is Tullahoma, 4.5 miles to the west.

4.0 ENVIRONMENTAL CONSEQUENCES OF ACTION ALTERNATIVES

This section discusses the potential impacts of the GWEN project on the environmental setting of the three CGSs in central Tennessee. Several impacts which would be common to all of the action alternatives are discussed in Section 4.1 of this EA. Impacts that are unique to each action alternative are discussed in Sections 4.2 through 4.4 of this EA. The project would have significant visual impacts if built on the Camp Forrest site (CGS-2), as indicated in Section 4.2 of this EA. Impacts to historic properties are unknown on the Camp Forrest (CGS-2) and UTSI Road (CGS-4) sites, and impacts on water quality are unknown on the UTSI Road (CGS-4) site. These sites conflict with FAA flight safety requirements which preclude construction of a tower on these sites and studies were not completed, as discussed in Sections 4.2 and 4.4 of this EA. There would be no significant impacts on the Fire Tower site (CGS-3), as indicated in Section 4.3 of this EA.

4.1 Common Features

Presented below is information on the physical, biological, and socio-cultural impacts common to all of the action alternatives. None of these common impacts would be significant.

4.1.1 Physical

Impacts from **construction** activities would not be significant. Construction would require localized earth-moving, including excavation and backfilling for placement of foundations and guy-wire anchors. Less than 3,800 square feet would be covered with concrete and gravel for the tower base and the equipment area enclosures. Similar coverage would be required for on-site access roads and parking; incidental activities during construction would disturb a similar amount. In total, about 0.25 acre would be occupied by foundations and the on-site access roads. Construction of the off-site access road and installation of utility lines would have no significant impacts because they would cover no more than 700 square feet of land at any site and would be along previously graded USAF roads.

The ground plane would be installed using machines that bury wire approximately 1 foot below the surface with minimal disturbance of the soil surface. This process would require moving a small tractor or similar equipment over much of the 11-acre site, but would not significantly disturb the existing vegetation or create a significant erosion hazard.

Impacts on **mineral resources** would be minor, as indicated in Section 4.1.1.4, page 4.1-2 of the FEIS. There are no economic mineral deposits known at Arnold AFB or vicinity (TBG, 1989). If any mineral resources are present under a site, development of the site would only deny access to a small portion of those resources for the lifetime of the project and would not result in any significant impacts.

Impacts on **paleontological resources** would not be significant. No significant paleontological resources are known to occur on any CGS, as discussed in Section 3.1.1 of this EA. However, if any fossils are found during construction, work that might affect them would be suspended while the Tennessee Geological Survey Bureau is notified and the significance of the find is evaluated.

Erosion and increase in storm water runoff would not be significant. All sites have slopes that do not exceed 1 percent, so any required grading to level the site would be minimal. In addition, standard measures for erosion control would be used during and after site construction, including replanting the site.

None of the sites is located in a 100-year **floodplain** (FEMA, 1978).

No **prime farmland** would be removed from production for the project, as the soils on the sites are not classified as prime farmland (TBG, 1989).

No significant impacts on **drinking water** are expected, as discussed in Sections 3.2.4.1 and 4.2.1.1, pages 3.2-2 and 4.2-3 of the FEIS. Corrosion of the ground plane is not anticipated to raise copper concentrations in any aquifer or surface water body by more than 20 micrograms per liter (µg/l). This would represent 2 percent of the maximum

allowable copper concentrations permitted by the State of Tennessee for raw water sources for potable water supply (Tennessee Administrative Code, Title 69, Chapter 1200-4). The Tennessee standard is the same as the Environmental Protection Agency (EPA) standard, which is intended to maintain the aesthetic properties that relate to public acceptance of drinking water and is not related to public health. A threshold for the effects of copper on human health has not been determined (EPA, 1985).

Impacts on **surface water or wetlands** that support aquatic plants and animals are unknown on the UTSI Road site (CGS-4). This site has conflicts with the FAA which preclude construction of a tower. Therefore, the Tennessee Division of Water Management (TDWM) was not requested to comment on copper leachate impacts at CGS-4. Impacts on the Camp Forrest and Fire Tower sites (CGS-2 and CGS-3) would not be significant. Potential impacts from copper leachate could occur when the site is less than 300 feet from surface water or wetlands, if the soil is acidic, or the depth to the seasonally high water table is less than 3 feet from the ground plane (4 feet from the surface), as discussed in Section 4.2.1.1, page 4.2-3 of the FEIS. The Camp Forrest Site (CGS-2) is not within 300 feet of surface water, therefore the increase in copper concentrations would be insignificant, as discussed in Section 4.2.1.1, page 4.2-3 of the FEIS. Although the Fire Tower site (CGS-3) is within 300 feet of surface water, the TDWM has determined that there would be no significant impacts.

Impacts on **air quality** would not be significant. Temporary but insignificant increases in air pollutant emissions would occur during construction, primarily from the use of heavy machinery. During operation of the BUPG at 100 percent load, total yearly emissions from the BUPG would be less than 350 pounds per pollutant, as described in Section 2.1.2 of this EA. These are well below the standards set by the Clean Air Act (42 USC 7401, *et seq.*), which requires permits for facilities emitting any single regulated substance at the rate of 50 tons per year. Hence, the project would not result in violation of National Primary and Secondary Ambient Air Quality Standards, which have been adopted by the State of Tennessee (Tennessee Administrative Code, Title 68, Chapter 1200-1).

4.1.2 Biological

Impacts on **biological resources** would not be significant. The Camp Forrest site (CGS-2) is currently a field of young pine trees. The Fire Tower site (CGS-3) is an agricultural field planted with row crops. The UTSI Road site (CGS-4) was clear cut and has been replanted with pine trees. Each site is at least 2 miles from any lakes or rivers (USGS, 1982a-b). No critical or exceptionally valuable wildlife habitats would be at risk or would be close enough to attract waterfowl or other wildlife to the tower's vicinity.

No federally listed **threatened or endangered species** would be adversely affected. This determination was made after consultation with the USFWS in compliance with Section 7 of the Endangered Species Act of 1973, as amended (16 USC 1531 *et seq.*, at 1536) (Appendix C, Barclay, 1992, 1993 pages C-9 to C-10 and C-12 of this EA). The only species cited by the USFWS as possibly occurring in the SSA are the leafy prairie clover and the Tennessee yellow-eyed grass, both endangered (Appendix C, Barclay, 1992, 1993 pages C-9 to C-10 and C-12 of this EA). The habitats for these species are not found on the CGSs. The leafy prairie clover requires rocky sites and the Tennessee yellow-eyed grass requires moist sites. The CGSs contain no springs, streams, or wet areas and they are either agricultural fields or are planted with trees. The USFWS concurs that the project would cause no adverse effects to these species (Appendix C, Barclay, 1992, page C-11 of this EA). The species listed by the state of Tennessee as rare, threatened, or endangered are in portions of Arnold AFB not affected by this project and would not be impacted (TBG, 1989).

Bird collisions with the tower may occur but are not expected to be significant. Section 4.4.1.5, page 4.4-5 of the FEIS states that the majority of bird collisions occur in adverse weather conditions when the visibility of man-made structures is obscured and birds are forced to lower their flight level. Generally, songbirds (passerines) are more likely to collide with a tower or the guy wires than are raptors or waterfowl (Avery *et al.*, 1980). Areas with high concentrations of bird flight activity, prominent topographical features that could serve as navigational aids, known migration corridors, and raptor roosting areas, were avoided. High tree lines and thick forest around the sites will also aid in the prevention of guy-wire collisions. Although the area around the Fire Tower

site (CGS-3) is planted with corn as part of the wildlife program, the cornfield's distance from Woods Reservoir and other wetlands indicates that the species most likely to forage there are upland species not on the federal or state threatened or endangered species lists.

The northern wetlands area of Arnold AFB is at least 4.5 miles from the UTSI Road site (CGS-4), 6 miles from the Fire Tower site (CGS-3), and 6.5 miles from the Camp Forrest site (CGS-2). Woods Reservoir is at least 2 miles from the UTSI Road site (CGS-4), 4.5 miles from the Fire Tower site (CGS-3), and 6 miles from the Camp Forrest site (CGS-2). Each site is therefore outside the primary foraging zone that surrounds these two critical and/or exceptionally valuable habitats. Waterfowl enter and leave these areas from all directions and show no preferred migratory path. Although Elk River is a minor migratory flyway, it is more than 2 miles to the south of the UTSI Road site (CGS-4), 5 miles southeast of the Fire Tower site (CGS-3), and 6.5 miles from the Camp Forrest site (CGS-2); the GWEN facility would therefore not pose a significant hazard to migratory birds.

4.1.3 Socio-Cultural

Local employment would be increased slightly, primarily through use of local subcontractors for earth-moving and possibly for some of the facility's maintenance.

Impacts on **community support systems** would not be significant because the relay node will be unmanned and will use modest amounts of power (comparable to that used by an average single-family house). Security needs will be met by Arnold AFB security personnel who will monitor the integrity of the site during routine patrols, as detailed in Section 4.6.1.1, page 4.6-1 of the FEIS.

Impacts on **land use** would not be significant. Each candidate site is unzoned government-owned land, and a GWEN facility would be compatible with the surrounding land use (Dunne, 1989). Care was taken in the site selection process to maintain setbacks from institutional uses such as schools, churches, recreational areas, and areas zoned residential. The tower would not significantly affect property values because non-noxious, nonresidential land uses, such as the proposed relay node, have

no systematic effect on housing values, as stated in Section 4.7.1.3, page 4.7-8 of the FEIS.

Construction noise impacts would be temporary and insignificant. Operational noise from the backup generator would be less than 72 dBA at the site boundary. At 50 feet beyond the site boundary the noise level would drop below 65 dBA, as discussed in Section 2.1.2 of this EA. The operations at Arnold AFB are not currently affected by any state, local, or EPA noise regulations or restrictions (TBG, 1989), and no CGS has residences within 50 feet of the site boundary.

Impacts on **public health and safety** would not be significant, as discussed in Sections 4.11 and 4.12 of the FEIS beginning on pages 4.11-1 and 4.12-1, respectively, of the FEIS. Shock and burn risks would be associated with the buildup of electrical charges on ungrounded metallic objects inside the inner exclusionary (8-foot) fence located approximately 20 feet from the tower base. However, a grounded person within the outer exclusionary (4-foot) fence located approximately 330 feet from the tower base who touches an ungrounded object while the tower was transmitting would experience only a mild shock, sufficient to cause the individual to break contact but not cause harm. Furthermore, because the transmission periods would total between 6 and 8 seconds per hour during normal operations, the risk of even these mild shocks would be insignificant. Only a determined effort to enter the inner exclusionary zones, within the 8-foot fence, would put a person at increased risk of higher shock and a higher specific absorption rate, dependent on the period of prolonged grasping contact with an ungrounded metallic object. Fire hazards at the relay node facility would be low, as discussed in Section 4.12.1.1, page 4.12-1 of the FEIS. Radio-frequency emissions would not cause adverse health effects as described in Section 4.4.1.6, pages 4.4-6 and 4.4-7 of the FEIS. Subsequent to the publication of the FEIS, further study confirmed the conclusion of the FEIS that there is no evidence of adverse effects of GWEN radio-frequency emissions on public health (NRC, 1992).

The relay node would operate in the LF band and therefore would not interfere with pacemakers, emergency communications, commercial and amateur radios, televisions, or garage door openers, as noted in Section 2.1.1.1, page 2-3 of the FEIS.

Impacts on **archaeological resources** would not be significant. An on-site archaeological survey identified no archaeological resources on any of the sites (DuVall, 1990). The Tennessee SHPO has concurred with this determination (Appendix C, Harper, 1990, page C-6 of this EA). The five previously recorded prehistoric archaeological sites along the Elk River are all more than 10 miles from any site (TBG, 1989). If any archaeological resources are found during construction, work that might affect them will be suspended while the Tennessee SHPO is notified in accordance with the provisions of 16 USC 470, *et seq*, at 470f.

Impacts on **historic properties** would not be significant. No properties that are listed or eligible for listing on the NRHP occur within 1.5 miles of any of the CGSs (NRHP, 1988). The Tennessee SHPO has concurred that construction of a tower on the Fire Tower site (CGS-3) will not affect properties which have been determined eligible for the NRHP (Appendix C, Harper, 1990, page C-7 of this EA; Appendix C, Hiebert, 1990, page C-8 of this EA). An historic structures survey of the Camp Forrest (CGS-2) and UTSI Road (CGS-4) sites was not conducted because of conflicts with FAA flight safety requirements. Impacts from these two CGSs are therefore unknown.

Significant impacts to **Native American traditional, religious, or sacred sites** are not anticipated. The BIA indicated that no federally recognized tribes currently live in Tennesssee and that the Shawnee are the only federally recognized tribe that historically occupied the area (Sutherland, 1992). The Absentee-Shawnee Executive Committee in Oklahoma and Eastern Shawnee Tribe of Oklahoma were notified of the GWEN project and information was requested regarding traditional, religious, or sacred sites within the SSA. A representative of the Eastern Shawnee Tribe of Oklahoma stated that the tribe has no concerns with the GWEN project in central Tennessee (Howser, 1992). No response to letters or phone calls has been received from the Absentee-Shawnee Executive Committee in Oklahoma. The Tennessee Commission on Indian Affairs indicated that no traditional, religious, or sacred sites exist on any CGS (Butler, 1990).

Visual impacts associated with a GWEN tower are discussed in Sections 3.8 and 4.8, pages 3.8-1 and 4.8-1, respectively, of the FEIS. The significance of a visual impact would depend on the visual dominance of the GWEN facility and the sensitivity of the affected views. Visual dominance is the degree to which a GWEN facility would compete with other features of the existing landscape for the attention of the viewer. Section 3.8.4, beginning on page 3.8-3 of the FEIS defines four levels of dominance, called Visual Modification Classes (VMC):

- VMC 1, not noticeable: the tower would be overlooked by all but the most interested viewers

- VMC 2, noticeable, visually subordinate: the tower would be noticeable to most viewers without being pointed out but would not compete with other features for their attention

- VMC 3, distracting, visually codominant: the tower would compete with other features in the landscape for the viewer's attention

- VMC 4, visually dominant, demands attention: the tower would be the focus of the attention and tend to dominate the view.

Visual sensitivity is a measure of the public's reaction to a proposed change of the affected view and is a function of the viewer's activity, awareness, goals, and values. Consequently, the more sensitive the view, the stronger will be the public reaction to any alteration of it. Areas defined in the FEIS as having high visual sensitivity include national and state parks; designated scenic routes; designated national, state, or local historic sites where setting is important to their historic significance; and travel routes providing primary access to these sites. Examples of areas having medium visual sensitivity would be locally popular, but undesignated, beaches or public use areas, and travel routes that provide primary access to them. Low visual sensitivity includes those views from sites, areas, travel routes, and sections of travel routes not identified as medium and high in sensitivity.

Significant visual impacts would occur if the relay node facility were to dominate or codominate (VMC 4 or 3) a high-sensitivity view or dominate (VMC 4) a medium-sensitivity view. If the relay node facility cannot be seen from medium-to-high sensitivity routes or areas, then visual impacts are not considered significant. Distance is the primary factor in determining visual dominance and therefore visual impacts. At distances greater than 3 miles, a GWEN tower would not be visible to the unaided eye. At 1.5 to 3 miles, the tower would be visually subordinate if noticeable (VMC 2) but more usually would not be noticed (VMC 1) because of its grey color and lack of mass. If a viewer at this distance actively sought the tower, it would appear as a thin vertical line on the horizon. Within 1.5 miles, the tower becomes a more important component of the view. In addition, other aspects of the tower's setting, such as focal point sensitivity, skyline complexity, competing feature interest, and topographic and vegetative screening, become important considerations in determining the level of visual impact.

USGS topographic maps and a windshield survey were used to determine whether high or medium sensitivity views were within 1.5 miles of the CGSs. The visual impacts associated with each site are discussed in Sections 4.2 to 4.4 of this EA.

4.2 Alternative 1: Camp Forrest Site (CGS-2)

Significant impacts are expected.

Visual impacts would be significant. The corporate city limits of Tullahoma are 0.2 mile west of the site, and the nearest residential area, a potentially high sensitivity view, is approximately 0.6 mile from the site boundary. The site is surrounded on all four sides by mature pine forest with stands reaching heights of 50 to 60 feet. In the view of the tower from the residential area to the southwest, these trees would screen the lower two thirds of the tower. The low skyline complexity above the tree line and the lack of competing feature interest would cause the upper third of the tower to be distracting (VMC 3), and the visual impacts on this residential area would therefore be significant.

Impacts on **surface water or wetlands** would not be significant because the site is more than 300 feet from surface water.

Impacts on **historic properties** are unknown. Since the site has conflicts with the FAA which preclude construction of a tower, an historic structures survey was not considered.

4.3 Alternative 2: Fire Tower Site (CGS-3)

No significant impacts are expected.

Impacts on **surface water or wetlands** would not be significant. A small seasonal pond and an intermittent stream are within 300 feet of the site, the soils are acidic, and the depth to the seasonally high water table is less than 2 feet. However, the TDWM has concurred that impacts from potential copper leachate into these intermittent surface waters would not be significant (Holland, 1990), because their periodic nature makes them unsuitable habitats for fish. The small amphibians, planktonic plants and animals, and aquatic flowering plants that these surface water sources might support are common and widely dispersed, and only small numbers of these species would be exposed to copper leachate.

Impacts on **historic properties** would not be significant. The Tennessee SHPO determined the project would not affect properties which have been determined eligible for listing on the NRHP (Appendix C, Harper, 1990, page C-7 of this EA).

Visual impacts at this site would not be significant. No medium or high sensitivity views occur within 1.5 miles of the site.

4.4 Alternative 3: UTSI Road Site (CGS-4)

Complete impacts are unknown.

Impacts on **water quality** are unknown. Since the site has conflicts with the FAA which preclude construction of a tower, the TDWM was not requested to comment on copper leachate impacts.

Impacts on **historic properties** are unknown. Because of the FAA conflicts, an historic structures survey was not considered.

Visual impacts would not be significant because there are no medium or high sensitivity views within 1.5 miles of the site.

4.5 No Action Alternative

No environmental impact would result from adoption of the no action alternative.

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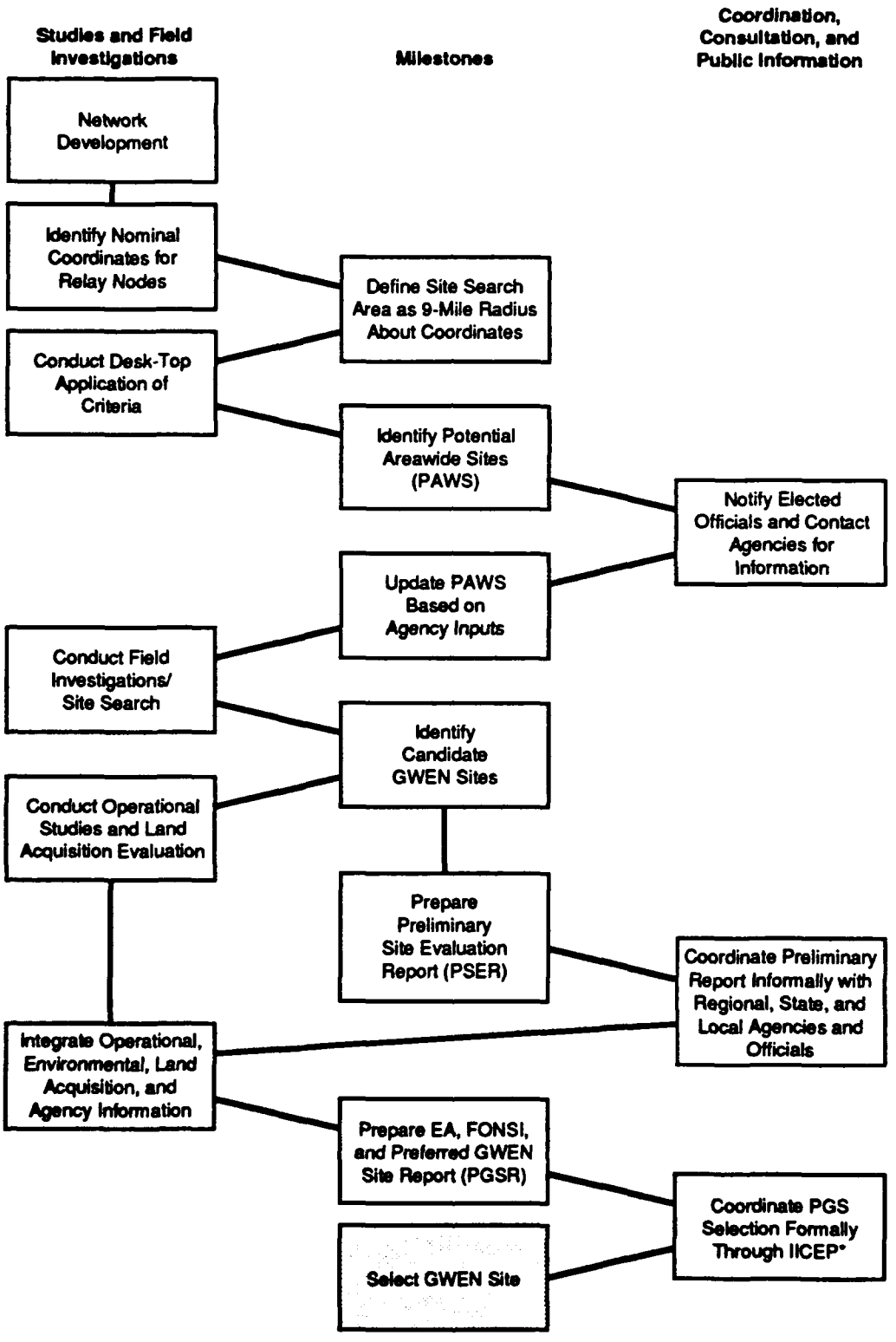
APPENDIX A

SITE SELECTION PROCESS

SITE SELECTION PROCESS

Figure A.1 of this EA shows the sequence of events during the selection of individual GWEN sites. Figure A.2 of this EA describes the screening process used during the field investigation to choose the candidate GWEN sites (CGSs). The environmental siting criteria applied in the site selection process are defined in Tables 5-1 and 5-2, pages 5-7 through 5-14 of the FEIS.



*IICEP = Interagency/Intergovernmental Coordination for Environmental Planning.

FIGURE A.1 GROUND WAVE EMERGENCY NETWORK SITE SELECTION PROCESS

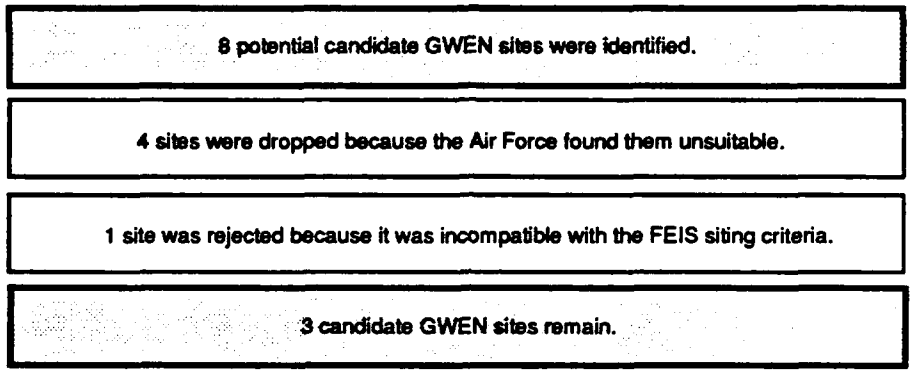


FIGURE A.2 RESULTS OF USING FEIS SITING CRITERIA TO SCREEN POTENTIAL CANDIDATE GWEN SITES IN THE CENTRAL TENNESSEE SITE SEARCH AREA

APPENDIX B

TOPOGRAPHIC SETTINGS OF CANDIDATE GWEN SITES

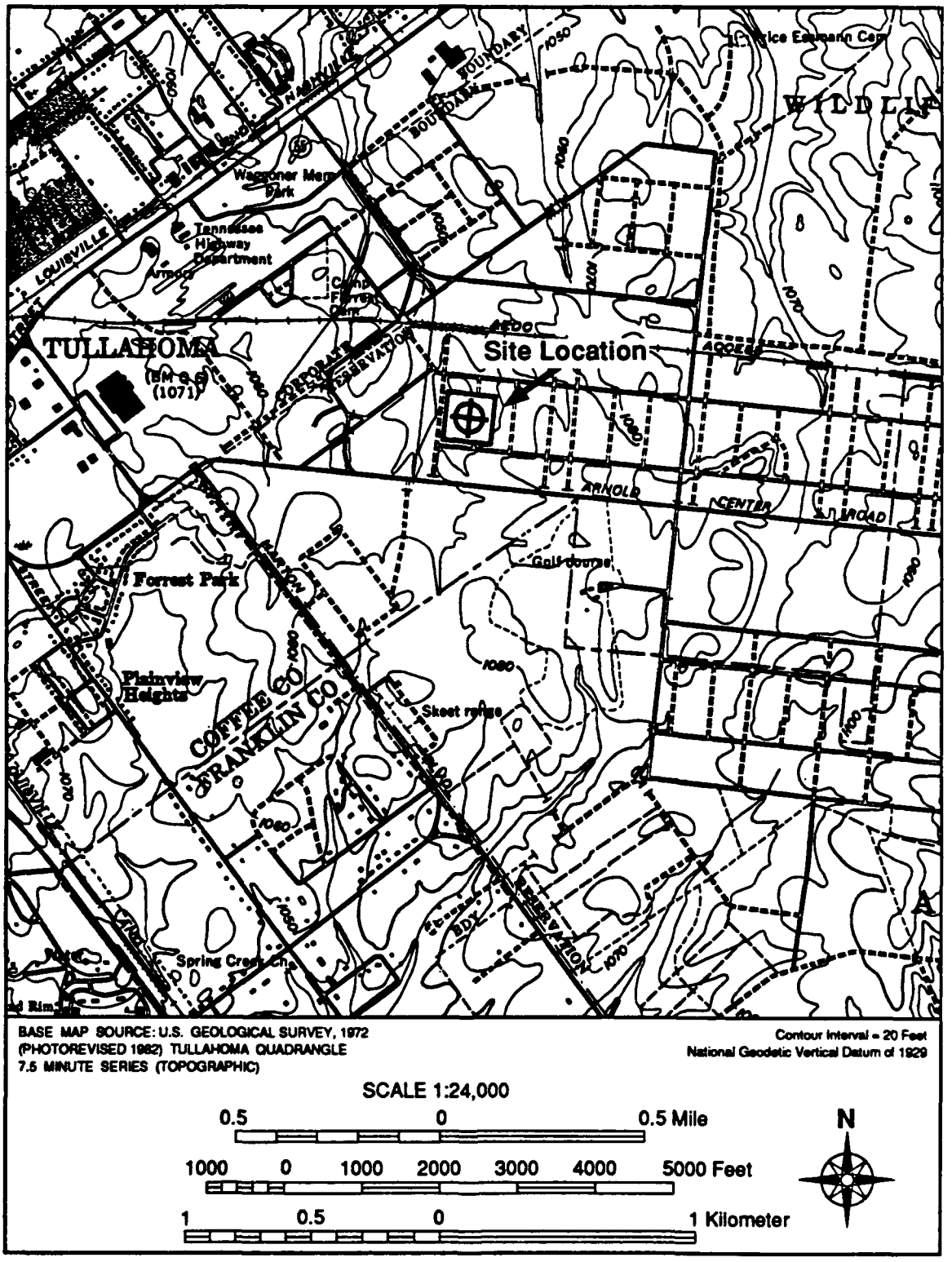


FIGURE B.1 TOPOGRAPHIC SETTING OF THE CAMP FORREST SITE (CGS-2)

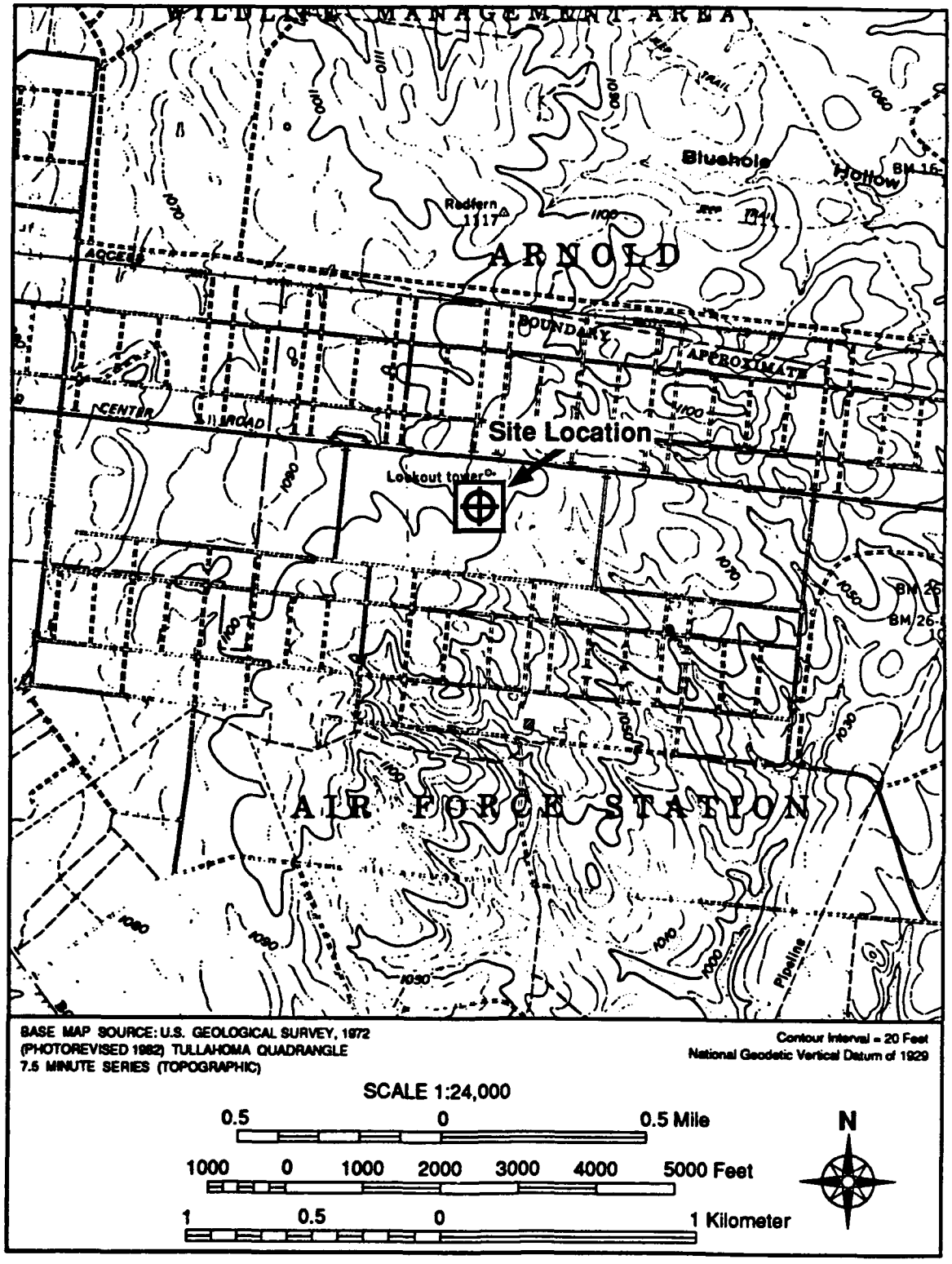


FIGURE B.2 TOPOGRAPHIC SETTING OF THE FIRE TOWER SITE (CGS-3)

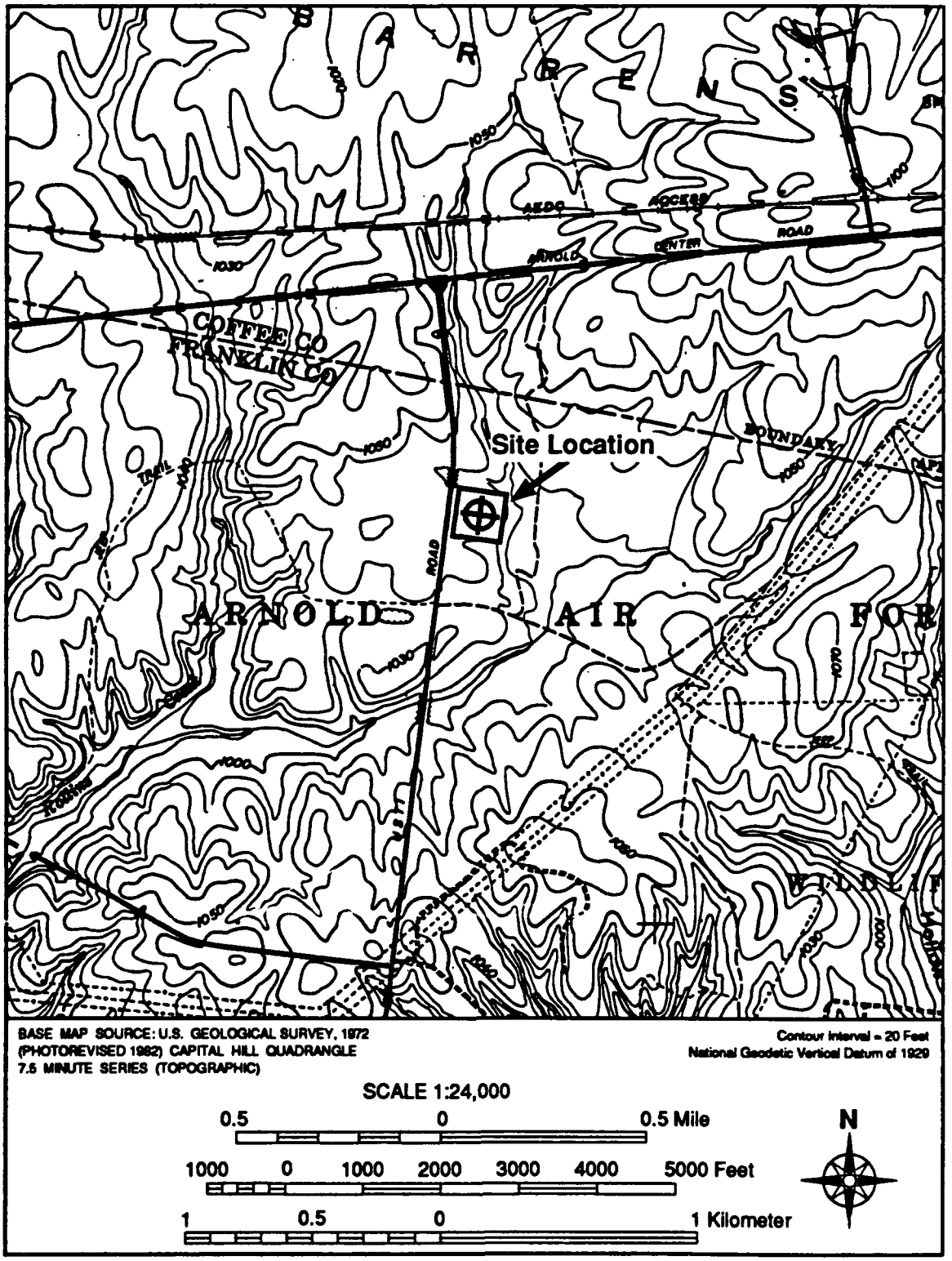


FIGURE B.3 TOPOGRAPHIC SETTING OF THE UTSI ROAD SITE (CGS-4)

APPENDIX C

CORRESPONDENCE

CORRESPONDENCE

Appendix C documents contacts with the following federal and state agencies and Native American groups:

Individual	Agency	Date	Response
Douglas Winford, Field Supervisor	U.S. Department of the Interior, Fish and Wildlife Service	04-03-90	Attached
Herbert Harper, Executive Director and Deputy State Historic Preservation Officer	Tennessee Historical Commission, Department of Conservation	02-06-90 03-31-90 09-27-90	Attached Attached Attached
David M. Hiebert, Historian	Department of the Air Force	09-14-90	Attached
Lee A. Barclay Field Supervisor	U.S. Department of the Interior, Fish and Wildlife Service	05-20-92 09-11-92 01-15-93	Attached Attached Attached
Luvenia H. Butler, Director	Department of Conservation, Tennessee Commission on Indian Affairs	A letter was sent on 05-23-90. No written response has been received. Verbal concurrence with no impact was received 06-20-90 (see page 5-1 of this EA).	

Individual	Agency	Date Response
J. Edwards, Governor	Absentee-Shawnee Executive Committee	Letter sent on 08-25-92, but no response has been received to the letter or to several attempts at phone communication.
G. Captain, Chief	Eastern Shawnee Tribe of Oklahoma	Letter sent on 08-25-92; no written response; phone communication with P. Howser 09-24-92 (see page 5-2 of this EA).

United States Department of the Interior
FISH AND WILDLIFE SERVICE
Post Office Box 845
Cookeville, TN 38503

April 3, 1990

Stephen T. Martin, Lt Col, USAF
Program Manager, GWEN
Department of the Air Force
Headquarters Electronic Systems Division
Hanscom Air Force Base, MA 01731-5000

Dear Sir:

In response to your letter of January 31, 1990 concerning the selection of candidate sites for the Ground Wave Emergency Network (GWEN) relay node in Central Tennessee, we have reviewed the three sites located on the Arnold Air Force Base.

According to our records there are no federally listed or proposed endangered or threatened species in the project impact area. Therefore requirements of Section 7 of the Endangered Species Act are fulfilled. Consultation should be reinitiated if (1) new information reveals impacts not previously considered to listed species, (2) the project is subsequently modified, or (3) new species are listed or critical habitat designated that may be impacted.

We appreciate the opportunity to review and comment at this early stage of project planning.

Sincerely,

Douglas B. Winford
Field Supervisor

JCW/b

TENNESSEE HISTORICAL COMMISSION
DEPARTMENT OF CONSERVATION
701 BROADWAY
NASHVILLE, TENNESSEE 37219-5237
615/742-6716

February 6, 1990

Stephen T. Martin, Lt Col, USAF
Program Manager, GWEN
Department of the Air Force
Headquarters Electronic Systems Division (AFSC)
Hanscom Air Force Base, Massachusetts 01731-5000

Re: Proposed Candidate Sites for the Ground Wave Emergency Network (GWEN), Arnold Air Force Base, Coffee and Franklin Counties, Tennessee.

Dear Colonel Martin:

The above-proposed undertaking has been reviewed with regard to National Historic Preservation Act compliance by the participating federal agency or its designated representative. Procedures for implementing Section 106 of the Act are codified at 36 CFR 800 (51 FR 31115, September 2, 1986).

Due to the potential for archaeological resources eligible for the National Register of Historic Places, the selected candidate GWEN site (#2, #3, or #4) will require an archaeological survey. Manual shovel tests, if appropriate, should be conducted in conjunction with the survey to determine if buried cultural deposits are present.

Enclosed is a list of consulting archaeologists for your information. If you have any questions, please contact Mike Moore of the Division of Archaeology at (615) 742-6606. Your cooperation in this matter is appreciated.

Sincerely,

Herbert L. Harper
Executive Director and
Deputy State Historic
Preservation Officer

HLH:mm
enc.

TENNESSEE HISTORICAL COMMISSION
DEPARTMENT OF CONSERVATION
701 BROADWAY
NASHVILLE, TENNESSEE 37219-5237
615/742-6716

March 31, 1990

Ms. Holly Mendel
SRI International
333 Ravenswood Ave.
Menlo Park, California 94025

Re: An Archaeological Reconnaissance of the Proposed Ground Wave Emergency Network (GWEN) Tower Locations, Reference Numbers 4E911Tn/CGS-2, 3, and 4, Coffee and Franklin Counties, Tennessee.

Dear Ms. Mendel:

Our office has reviewed the above-referenced report by Mr. Glyn DuVall in accordance with 36CFR800 (51 FR 31115, September 2, 1986). Based upon the information provided by Mr. DuVall, we concur that there are no cultural resources eligible for listing on the National Register of Historic Places within the project area. Therefore, this office has no objection to the implementation of the project as currently proposed.

If you have any questions, please contact Mike Moore of the Division of Archaeology at (615) 742-6606. Thank you for your cooperation in this matter.

Sincerely,

Herbert L. Harper
Executive Director and
Deputy State Historic
Preservation Officer

HLH:mm
xc: Glyn DuVall

TENNESSEE HISTORICAL COMMISSION
701 BROADWAY
DEPARTMENT OF CONSERVATION
NASHVILLE, TENNESSEE 37243-0442
615/742-6716

September 27, 1990

David M. Heibert
Arnold Engineering
Development Center
Arnold AFB, Tennessee 37389-5000

Re: DOD, ARNOLD AFB/ARCHITECTURAL SURVERY, TULLAHOMA, COFFEE COUNTY, X

Dear Mr. Heibert:

Pursuant to your request, this office has reviewed your letter dated September 14, 1990, plus additional documentation relative to the above-referenced undertaking. Based on available information, we find that the project as currently proposed will not affect properties which have been determined eligible for listing in the National Register of Historic Places.

Therefore, this office has no objection to project implementation. Questions and comments may be directed to Joe Garrison (615)742-6720. Your cooperation is appreciated.

Sincerely,

Herbert L. Harper
Executive Director and
Deputy State Historic
Preservation Officer

HLH/jyg

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS ARNOLD ENGINEERING DEVELOPMENT CENTER (AFSC)
ARNOLD AIR FORCE BASE, TENNESSEE 37389-5000

Mr Joe Garrison
TENNESSEE HISTORICAL COMMISSION
Department of Conservation
701 Broadway
Nashville, TN 37219-5237

14 September 1990

Dear Mr Garrison

This letter is to confirm our recent conversation regarding the inventory of cultural resources at Arnold Engineering Development Center (AEDC), specifically the land within a 1.5-mile radius of the proposed GWEN site. It is my professional opinion that there is no historically significant property and no cultural resources within the designated area, which is in fact surrounded by dense woods. Should you have additional questions, please call me at 615/454-4203.

I would appreciate receiving a letter from your office to the effect that no cultural resources exist within the proposed project area. Thank you for your assistance in this matter.

Sincerely

—5—

DAVID M. HIEBERT
Historian

cc: AEDC/DEV

United States Department
of the Interior
Fish and Wildlife Service
Attn: Mr Douglas B. Winford
~~P.O. Box 845~~ 446 Neal St
Cookeville, TN 38503

RE: U.S. Air Force Ground Wave Emergency Network (GWEN) Project in Central Tennessee

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This is to verify that there are no federally-designated threatened, endangered, or candidate species likely to be found within the GWEN project area as stated in our letter of April 3, 1990.

Douglas B. Winford _____ Date _____

Changes have been made to the list of federally-designated threatened, endangered, or candidate species since our correspondence to you on April 3, 1990. Enclosed is a new list of species likely to be found in the GWEN project area and which may be affected by the project.

Lee A. Barclay
~~Douglas B. Winford~~
Lee A. Barclay
Field Supervisor

5/20/92
Date

Recently listed species that may occur in the vicinity of the Central Tennessee *GWEN Project.*

LISTED SPECIES

Leafy prairie clover - Dalea foliosa (E)

Tennessee yellow-eyed grass - Xyris tennesseensis (E)

United States Department of the Interior
FISH AND WILDLIFE SERVICE
~~Post Office Box 445~~
~~Cookeville, TN 38503~~

TAKE PRIDE IN AMERICA

September 11, 1992

NEW ADDRESS:
446 Neal Street
Cookeville, TN 38501

Mr. Arthur McGee
Senior Consultant
SRI International
333 Ravenswood Avenue
Menlo Park, California 94025

Re: 4-C-92-775

Dear Mr. McGee:

We have reviewed the assessment regarding the leafy prairie clover and yellow-eyed grass, for Ground Wave Emergency Network in Coffee County, Tennessee, submitted August 19, 1992.

The assessment is adequate and supports the conclusion of no effect with which we concur. In view of this, we believe that the requirements of Section 7 of the Endangered Species Act have been satisfied. However, obligations under Section 7 of the Act must be reconsidered if (1) new information reveals impacts of this identified action that may affect listed species or critical habitat in a manner not previously considered, (2) this action is subsequently modified to include activities which were not considered in this assessment, or (3) a new species is listed or critical habitat determined that may be affected by the identified action.

Your interest and initiative in enhancing endangered and threatened species are appreciated.

Sincerely,

Lee A. Barclay, Ph.D.
Field Supervisor

Unites States Department
of the Interior
Fish and Wildlife Service
Attn: Mr Lee A. Barclay
446 Neal Street
Cookeville, TN 38501

RE: U.S. Air Force Ground Wave Emergency Network (GWEN) Project in Central Tennessee

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This is to verify that no changes have been made to the list of federally-designated threatened, endangered, or candidate species sent on May 20, 1992.

Lee A. Barclay

Lee A. Barclay

1/15/93
Date

Changes have been made to the list of federally-designated threatened, endangered, or candidate species since our correspondence to you on May 20, 1992. Enclosed is a new list of species.

Lee A. Barclay

Date

APPENDIX D

GLOSSARY

GLOSSARY

Abbreviations and Units of Measure

AEDC	Arnold Engineering Development Center
AFB	Air Force Base
AM	Amplitude modulation
ATU	Antenna tuning unit
BIA	Bureau of Indian Affairs
Btu	British thermal unit
BUPG	Back-up power group
CGS	Candidate GWEN site
CFR	Code of Federal Regulations
dBA	Decibels on the A-weighted scale, which is a measure of the intensity of the sounds people can hear
EA	Environmental Assessment
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration

FEIS	Final Environmental Impact Statement; in this document, the term refers to the FEIS for the GWEN Final Operational Capability that was released in September 1987 by the U.S. Air Force, Electronic Systems Division, Hanscom Air Force Base, Massachusetts
FEMA	Federal Emergency Management Agency
FOC	Final Operational Capability, the third phase of development of GWEN
GWEN	Ground Wave Emergency Network
HEMP	High-altitude electromagnetic pulse
IICEP	Interagency and Intergovernmental Coordination for Environmental Planning, the formal review process for the EA
kHz	Kilohertz
kV	Kilovolt
LF	Low frequency
mg/l	Milligrams per liter (1 mg/l = 1 ppm)
MM	Modified Mercalli, a scale of the severity of earthquake effects
MSL	Mean sea level
NFS	National Forest Service

NRC	National Research Council, the principle operating agency of the National Academy of Sciences and the National Academy of Engineering
NRHP	National Register of Historic Places
OSHA	Occupational Safety and Health Administration
PAWS	Potential areawide sites; the portion(s) of an SSA left aiter application of those siting criteria that do not require a field survey, such as the location of national and state parks
PCGS	Potential candidate GWEN site; any site that is identified from roadside surveys as suitable for further investigation
PGS	Preferred GWEN site; the CGS identified by the Government that *represents the Government's preferred location for a relay tower*
ppb	Parts per billion
ppm	Parts per million
PSER	Preliminary Site Evaluation Report
µg/l	Micrograms per liter (1 µg/l = 1 ppb)
SCS	Soil Conservation Service, a unit of the U.S. Department of Agriculture

SHPO	State Historic Preservation Officer; the person responsible for administering the National Historic Preservation Act at the state level, reviewing National Register of Historic Places nominations, maintaining data on historic properties that have been identified but not yet nominated, and consulting with federal agencies concerning the impacts of proposed projects on known and unknown cultural resources
SSA	Site search area; the 250-square-mile area within which four to six CGSs are identified; the SSA is the area within a 9-mile radius of a set of nominal coordinates in the network design. It is used as a manageable range in which to conduct siting investigations
TBG	The Benham Group
TDWM	Tennessee Division of Water Management
TLCC	Thin Line Connectivity Capability; the second phase of development of GWEN
UHF	Ultrahigh frequency (band); specifically 300 to 3,000 megahertz
USAF	United States Air Force
USC	United States Code
USGS	United States Geological Survey
UTSI	University of Tennessee Space Institute
VMC	Visual Modification Class

Definitions

Air pollutant	An atmospheric contaminant, particularly the 15 atmospheric contaminants specified in federal and most state regulations
Candela	A unit of measure of the intensity of light equal to the brightness of one candle
Chert	A rock resembling flint and consisting essentially of cryptocrystalline quartz or fibrous chalcedony
Claypan	Hardpan consisting mainly of clay
Cultural resource	Prehistoric, Native American, and historic sites, districts, buildings, structures, objects, and any other physical evidence of past human activity
Dolomite	A limestone or marble rich in magnesium carbonate
Evaluative criteria	Applied to portions of a potential siting area for a GWEN facility to determine its suitability. Areas that rank low against evaluative criteria may be excluded from consideration, or given a low priority in the site selection process
Exclusionary criteria	Criteria used to eliminate or exclude highly sensitive areas or areas that do not meet the limits of acceptable performance from consideration for GWEN facilities

Federal jurisdictional wetland	As defined in the *Federal Manual for Identifying and Delineating Jurisdictional Wetlands* (GPO 1989-236-985/00336) a wetland is a class of habitats distinguished by the presence of saturation to the surface or standing water during at least 1 week of the growing season (wetland hydrology), a soil type characteristic of saturated or poorly drained conditions (hydric soils), and the predominance of plants that only or mostly occur on wet sites (hydrophytic vegetation)
Fragipan	A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand
Ground plane	A part of the antenna system consisting of buried copper wires that extend radially from the base of a GWEN tower for a distance of approximately 330 feet
Historic properties	For the purposes of this EA, historic properties are those above-ground structures and resources that are listed or eligible for listing on the National Register of Historic Places
Mississippian	Geological period during the Paleozoic era, 270 million to 350 million years ago

Modified Mercalli scale	A measure of the intensity of seismic activity based on human perception of the event and the potential for damage; the intensity is rated on a Roman numeral scale ranging from I to XII. An earthquake of MM intensity I would be detectable only by seismographs; MM intensity V would shake buildings, break dishes and glassware, and cause unstable objects to fall; MM intensity X would destroy most masonry and frame structures, bend railroad rails slightly, and cause large tidal waves and landslides; MM intensity XII would cause nearly total destruction of all buildings. Another commonly used seismic intensity scale, based on readings from a seismograph, is the Richter scale, which was developed in 1935. The Modified Mercalli scale is often used when the historic period to be covered includes data prior to 1935
Paleonto-logical	Pertaining to fossils or the study of fossils
Pennsylvanian	Geological period during the Paleozoic era, 270 million to 350 million years ago
Permian	Geological period during the Paleozoic era, 225 million to 270 million years ago
pH	A measure of acidity in which the lower the number, the more acid the substance; 7 represents neutrality
Phase I	A survey designed to identify properties that are listed, eligible for listing, or potentially eligible for listing on the National Register of Historic Places within the area that would be affected by a proposed project
Precambrian era	The geological periods that preceded the appearance of hard-bodied multicellular life forms about 600 million years ago

Prime farmland	Land that contains soils having high crop production either naturally or through modification; the U.S. Soil Conservation Service is responsible for designating prime farmland
Sedimentary rock	Rock formed by the consolidation or cementation of particles deposited by water or wind
Siliceous rock	Rock containing silicon dioxide; occurs in crystalline, amorphous, and impure forms as in quartz, opal, and limestone
Top-loading element	Portions of the GWEN antenna that extend diagonally from the top of the tower, which strengthen the signal and provide additional structural support like guy wires