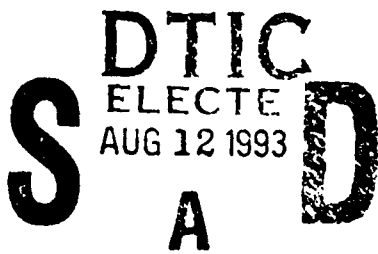


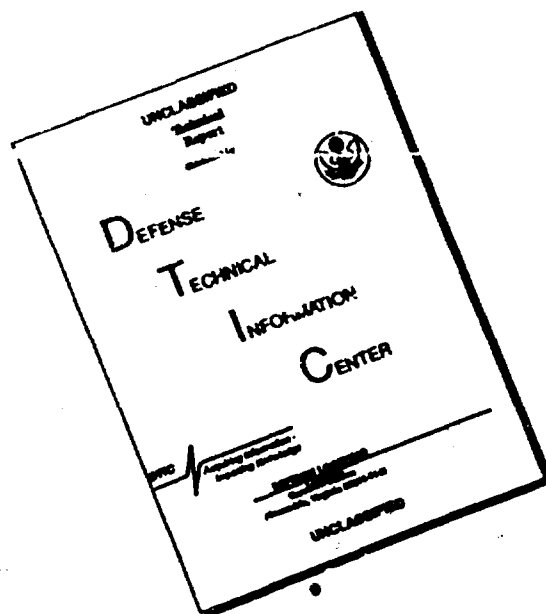
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**GROUND WAVE EMERGENCY NETWORK
FINAL OPERATIONAL CAPABILITY**

**ENVIRONMENTAL ASSESSMENT
FOR
SOUTHERN MISSOURI RELAY NODE
SITE NO. RN 8C910MO**

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11 February 1993

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

FINDING OF NO SIGNIFICANT IMPACT

NAME OF ACTION: GROUND WAVE EMERGENCY NETWORK
SOUTHERN MISSOURI RELAY NODE

DESCRIPTION OF PROPOSED ACTION ALTERNATIVES:

The U.S. Air Force plans to construct a radio communications relay node in southern Missouri (Stoddard County) as part of the Ground Wave Emergency Network (GWEN) communications system. Five action alternatives associated with five candidate GWEN sites (CGSs) in southern Missouri 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 southern Missouri 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 southern Missouri. Regional screening resulted in the identification of five CGSs in southern Missouri 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 five action alternatives and the no action alternative.

The proposed relay node in southern Missouri 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.

Only one of the five action alternatives discussed in the EA, the Jackson 1 site (CGS-4), is discussed in this Finding of No Significant Impact (FONSI). Because of potentially significant impacts to archaeological resources, the Jackson 2 (CGS-6), Walker (CGS-9), and Joseph (CGS-11) sites are not considered in this FONSI. There could also be significant impacts on surface water at the Jackson 2 site (CGS-6). The Cox site (CGS-12) was withdrawn prior to the archaeological resources survey, so impacts to archaeological resources are unknown.

ANTICIPATED ENVIRONMENTAL EFFECTS

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

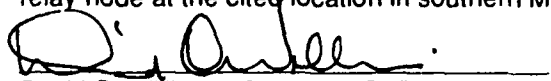
The project would have no significant impacts on physical resources. Erosion and increased runoff would be minimized by using proper erosion control techniques during construction and by replanting the site afterwards. Impacts on mineral resources would be minor. Paleontological resources are not likely to occur on the site; therefore, significant impacts to them are not anticipated. A maximum of 11 acres of 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 farmland and does not contain a sensitive wildlife habitat. The site does not contain wetlands, nor is it within a 100-year floodplain. At the recommendation of the U.S. Fish and Wildlife Service (USFWS), the relay node in southern Missouri will incorporate a dual lighting system on the tower and yellow aviation marker balls on the guy wires. With these measures to make the tower and wires more visible to birds, the bald eagle, the only federally listed threatened or endangered species, is not likely to be adversely affected by the project. The Missouri Department of Conservation indicated that no state-listed rare, threatened, or endangered species or unique biological communities occur 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 State Historic Preservation Program of Missouri was consulted and has determined 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 Jackson 1 site (CGS-4). Therefore, an environmental impact statement for a GWEN relay node at the cited location in southern Missouri is not required.



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

25 Feb 93
Date

PREFERRED GWEN SITE REPORT SOUTHERN MISSOURI

The U.S. Air Force is proposing to construct a relay node for the Ground Wave Emergency Network (GWEN) in southern Missouri. 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 five CGSs identified in southern Missouri are referred to as the Jackson 1, Jackson 2, Walker, Joseph, and Cox sites. Subsequent to the special studies being conducted, Mr Cox's property was withdrawn from further consideration by the Government due to ongoing litigation surrounding the ownership of that property. Mr Walker also withdrew his land from further consideration. However, the Air Force has made the decision to evaluate and publish the data already gathered on that site as well as the other three sites.

This report summarizes the process of selecting the preferred site from the four CGSs. This PGSR, along with a site-specific Environmental Assessment (EA) and Finding of No Significant Impact (FONSI), is also 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 sites.

Without an **operationally suitable** location, connectivity of the relay node in southern Missouri to the GWEN network cannot be achieved. Ground conductivity measurements are acceptable at all four CGSs. During the site-specific studies, no radio frequency interference was detected in the 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. Therefore, all four CGSs are operationally suitable.

The next major factor considered in the selection of the preferred site was **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 was completed in February 1993. The environmental analysis found that construction of a GWEN relay node at the Jackson 2, Walker, and Joseph sites would create potential significant impact to archaeological finds on each of the CGSs. The Jackson 1 site is the only site that has no significant environmental impact. A FONSI for this site was completed on 25 February 1993. Thus, only one of the four CGSs is environmentally suitable.

All four CGSs are suitable for development as a GWEN relay node. The FAA has approved construction of the GWEN relay node at any of the CGSs. **Construction costs** is also a consideration in the selection of the preferred site and the costs at each site are below average and not significantly different. Therefore, developmental suitability and construction costs are not major discriminators in the selection of the preferred site.

Real estate negotiations have been completed for the Jackson 1, Jackson 2, and Joseph sites. The owner of the Walker site announced his desire to withdraw from further consideration at the time of negotiations. The owner of the Jackson sites is more interested in selling his properties, while the owner of the Joseph site wishes to

have his property leased. The negotiated purchase prices of the Jackson sites were considerably higher than the appraised value, however, they are still more reasonably priced than leasing the Joseph site.

With operational, environmental, and developmental factors evaluated and acquisition and construction costs considered, the Air Force prefers the Jackson 1 site. The Jackson 1 site is preferred because it is the only environmentally suitable site.

I have therefore selected the Jackson 1 site as the Air Force's preferred site for development as the GWEN relay node in southern Missouri. After reviewing the information received during the II CEP process, I will direct the final land acquisition activities and construction of the GWEN relay node.


STEPHEN T. MARTIN, LT COL, USAF
Program Manager, GWEN

3 March 93

(Date)

GROUND WAVE EMERGENCY NETWORK
FINAL OPERATIONAL CAPABILITY

ENVIRONMENTAL ASSESSMENT
FOR
SOUTHERN MISSOURI RELAY NODE
SITE NO. RN 8C910MO

11 February 1993

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

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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 strengthening 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 southern Missouri, 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 centered north of the town of Dudley in Stoddard County, southern Missouri, at latitude 36.85° N and

longitude 90.07° W. A small portion of Butler County is included in the SSA. Other principal towns in the SSA are Dexter, Bloomfield, and Puxico.

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 southern Missouri was conducted in October 1989. Sixteen sites were identified during automobile-based surveys as potential candidate GWEN sites (PCGSs). All PCGSs were located in Stoddard County. Attempts were made to contact the owners of the sites to determine their interest in selling or leasing land to the Government. Rights-of-entry were granted to investigate twelve PCGSs. Following evaluation against the environmental siting criteria set forth in the FEIS, five of the twelve PCGSs were recommended as candidate GWEN sites (CGSs) for further review. These CGSs were described in the Preliminary Site Evaluation Report (PSER) of December 6, 1989.

Subsequent to the PSER being issued, and the majority of the site-specific studies being accomplished, two sites were withdrawn from consideration. One site (Cox, CGS-12) was withdrawn by the Government due to litigation surrounding ownership of that property. However, since study work on that site, with the exception of the archaeological segment, had been completed prior to the site's withdrawal by the Government, the Air Force decided to present that data in this EA. The second site (Walker, CGS-9) was withdrawn from consideration by the landowners. The landowners are no longer interested in leasing or selling land to the Government. However, since all site-specific studies had been accomplished prior to the owners' withdrawal and because CGS-9 continues to be considered a viable alternative, the Air Force has presented this data on the withdrawn site 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 that evaluation and discusses the five siting alternatives in southern Missouri. It addresses

only those criteria that apply to the candidate sites. The sixth 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 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 relay node structures. The site should also 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 and 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 Jackson 2 (CGS-6), Walker (CGS-9), or Joseph (CGS-11) site could have significant impacts on archaeological resources, as discussed in Sections 4.3, 4.4, and 4.5 of this EA. There could also be significant impacts on surface water at the Jackson 2 site (CGS-6).

The potential for impacts on archaeological resources at the Cox site (CGS-12) is unknown because it was withdrawn before the archaeological survey was undertaken. The site was withdrawn from further consideration by the Government due to litigation surrounding ownership of that property.

The project would have no significant impacts if built on the Jackson 1 site (CGS-4). 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; biological resources, including threatened and endangered species; mineral resources; known paleontological resources; or cultural resources that are listed, eligible, or

potentially eligible for listing on the National Register of Historic Places. 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 southern Missouri (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.

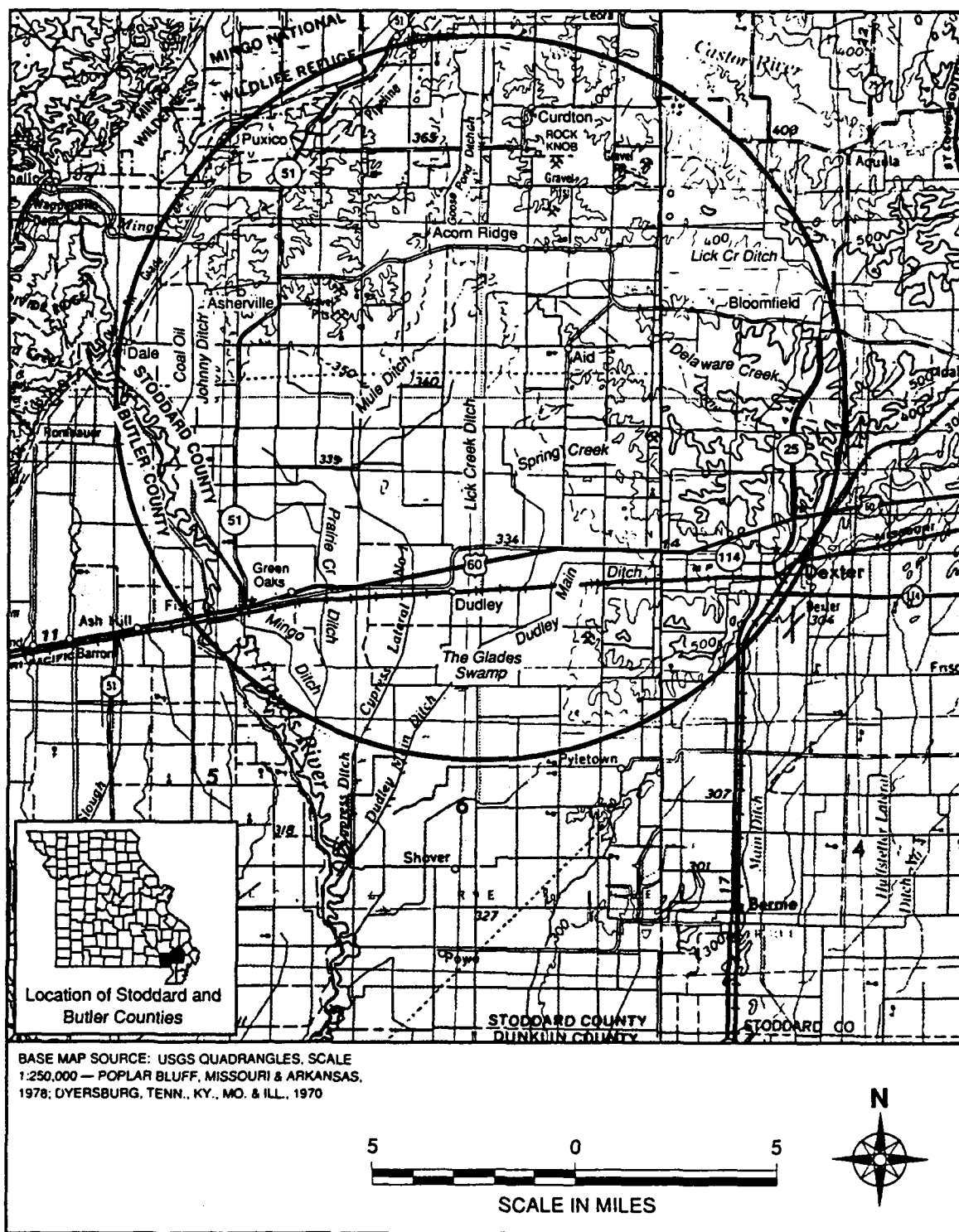


FIGURE 1.1 SOUTHERN MISSOURI SITE SEARCH AREA (SSA), STODDARD AND BUTLER COUNTIES, MISSOURI

2.0 ALTERNATIVES INCLUDING THE PROPOSED ACTION

The five 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 2.6 of this EA. Site descriptive data was obtained during field investigations conducted in October 1989. Figure 2.1 of this EA shows the five 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. Once the optimal coordinates of the relay nodes were identified, a 9-mile-radius SSA was defined around each point to provide suitable opportunity for siting a relay node near that point. The 9-mile radius was chosen because it provided a reasonably sized search area consistent with the technical constraints on the relay node. If a significant portion of an SSA fell within an environmentally highly sensitive area such as a national park or wilderness area, an alternative was selected and its connectivity evaluated. This process was repeated until all relay nodes fell outside such areas.

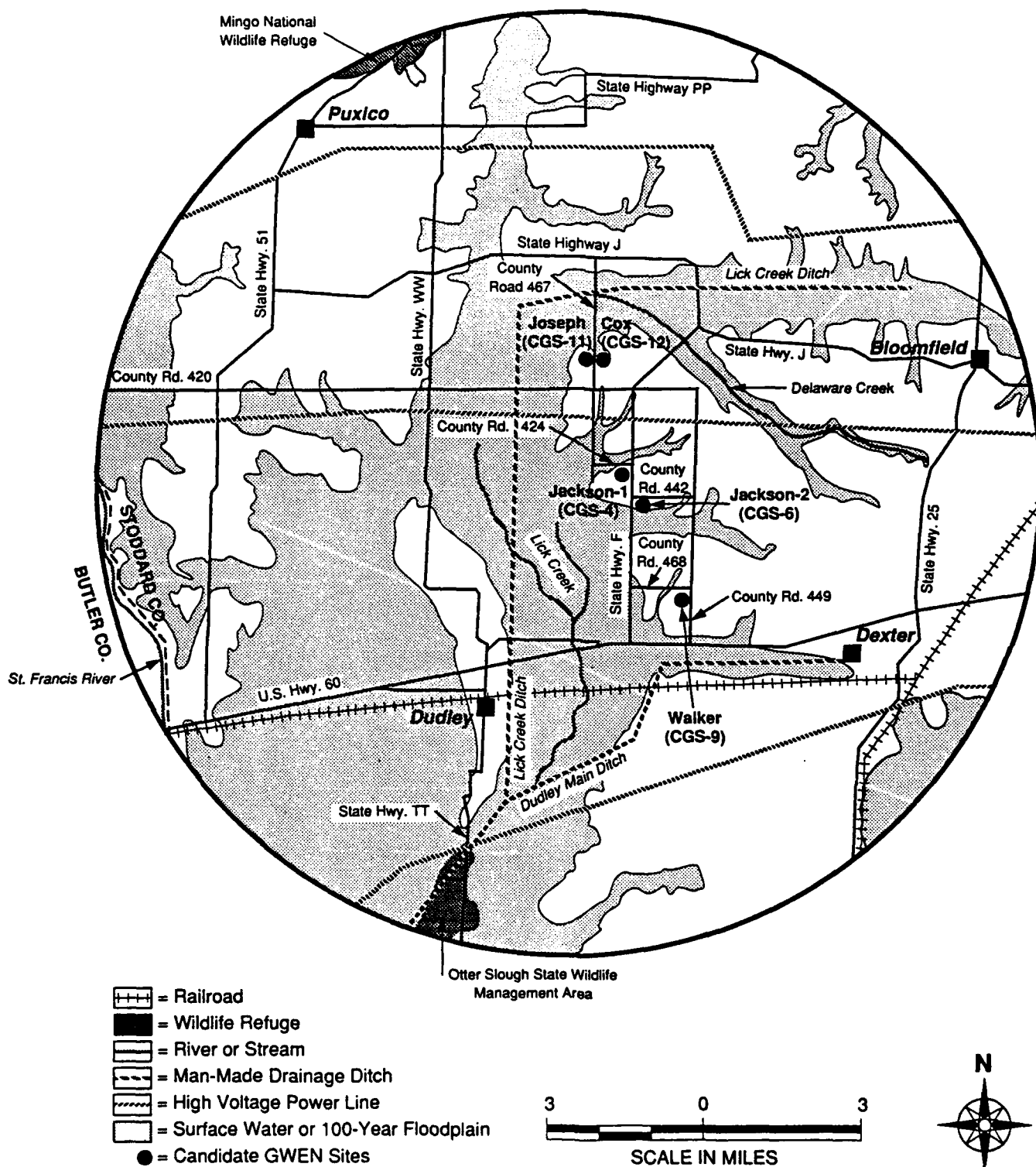


FIGURE 2.1 LOCATIONS OF CANDIDATE GWEN SITES (CGSs) RELATIVE TO SELECTED MAJOR FEATURES AND ROADS WITHIN THE SOUTHERN MISSOURI SITE SEARCH AREA

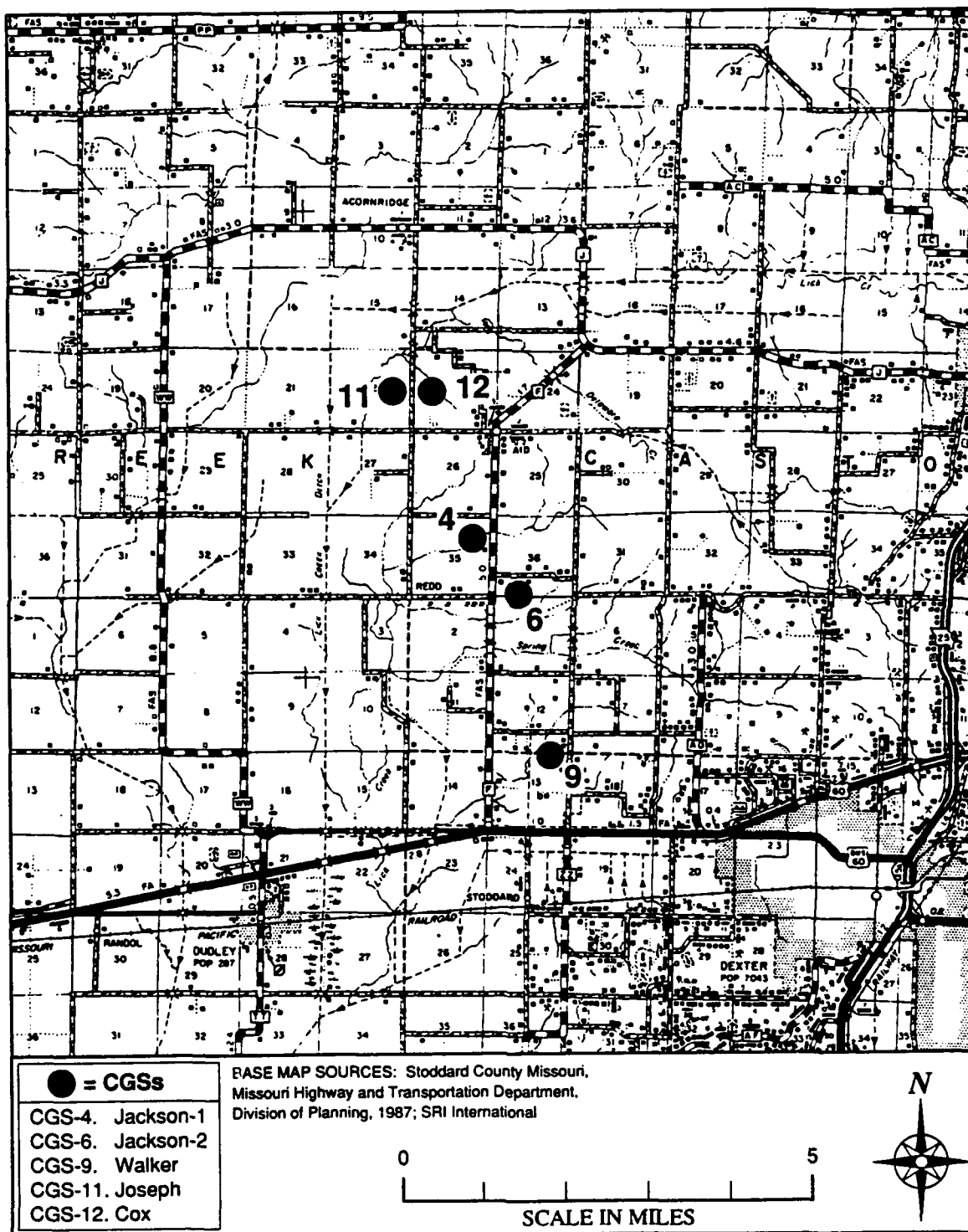


FIGURE 2.2 LOCATIONS OF CANDIDATE GWEN SITES (CGSs) IN STODDARD COUNTY

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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 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.

A field investigation for southern Missouri was conducted in October 1989. Sixteen sites were identified during automobile-based surveys as potential candidate GWEN sites (PCGSs). All PCGSs were located in Stoddard County. Attempts were made to contact the owners of the sites to determine their interest in selling or leasing land to the Government. Rights-of-entry were granted to investigate twelve PCGSs. Following evaluation against the environmental siting criteria set forth in the FEIS, five of the twelve PCGSs were recommended as candidate GWEN sites (CGSs) for further review. These sites were described in the Preliminary Site Evaluation Report (PSER) of December 6, 1989.

Subsequent to the PSER being issued, and the majority of the site-specific studies being accomplished, two sites were withdrawn from consideration. One site (Cox, CGS-12) was withdrawn by the Government due to litigation surrounding ownership of that property. However, since study work on that site, with the exception of the archaeological segment, had been completed prior to the site's withdrawal by the Government, the Air Force decided to present that data in this EA. The second site (Walker, CGS-9) was withdrawn from consideration by the landowners. The landowners are no longer interested in leasing or selling land to the Government. However, since all site-specific studies had been accomplished prior to the owners' withdrawal and because CGS-9 continues to be considered a viable alternative, the Air Force has presented this data on the withdrawn site in this EA.

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 southern Missouri. These are summarized in Sections 4.2 through 4.6 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

The southern Missouri 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 will be marked with 42 nine-inch yellow aviation marker balls to make the tower more visible to birds during flight, at the request of the United States Fish and Wildlife Service (USFWS). (See also Section 4.1.2 of this EA.)

The guy wires and top-loading elements are attached to the tower and 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 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.

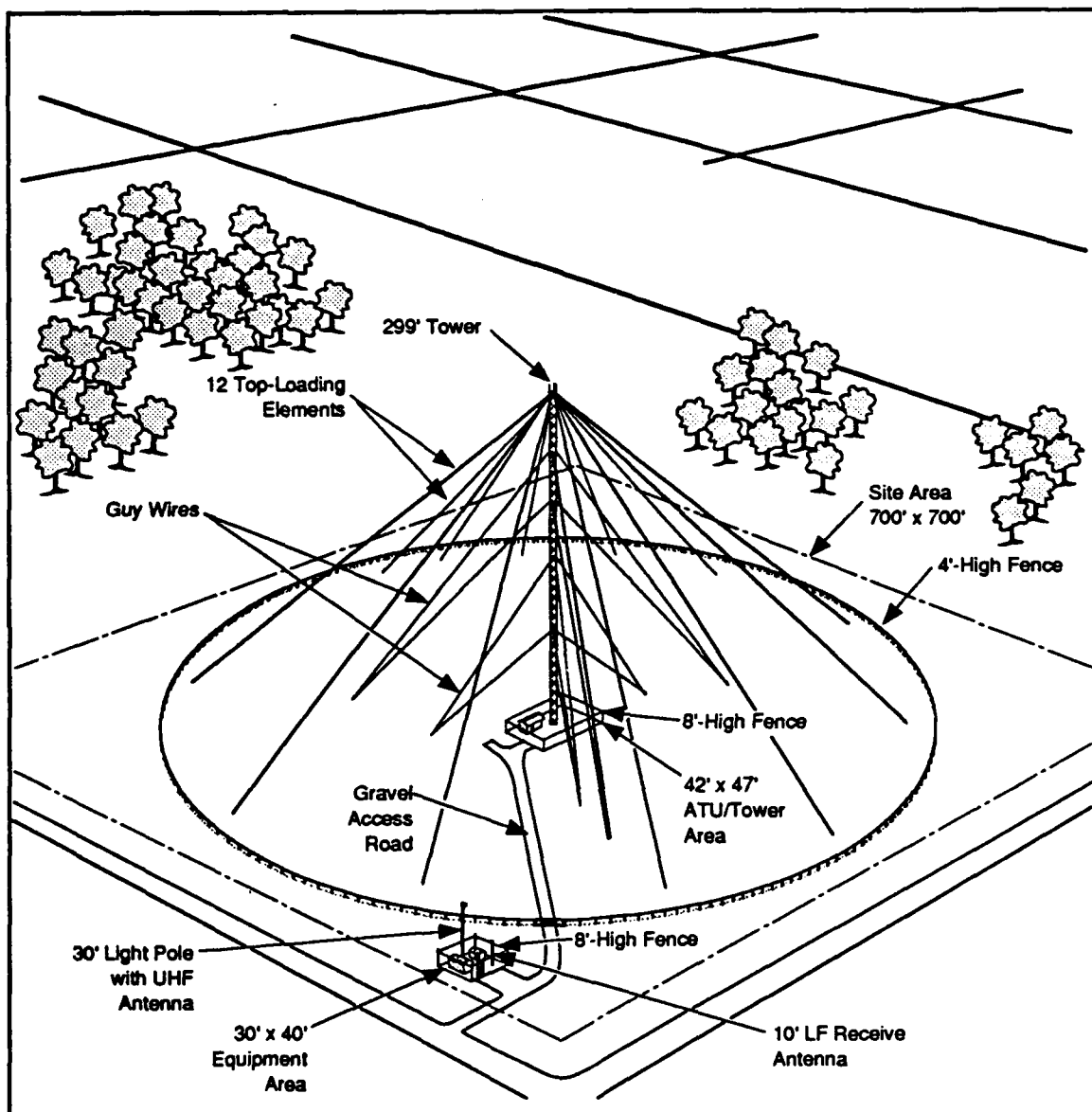


FIGURE 2.3 TYPICAL LAYOUT OF FOC RELAY NODE STATION

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. An FAA-approved dual lighting system will be installed within 10 feet of the top of the tower. During daytime and twilight, the system uses a white strobe light that emits 40 flashes per minute and is rated at 20,000 candelas. To minimize glare at ground level, the light is focused upward and horizontally outward. During nighttime and other periods of low light intensity, the system uses a blinking red light at the top of the tower that emits 20 to 40 flashes per minute and is rated at 1,500 candelas. Two steady-burning red lights, rated at not less than 32.5 candelas, are located at an intermediate level on the tower. The lights will be controlled automatically by a photo cell/controller device adjusted to switch from white strobe light to red flashing light and steady-burning red lights when the northern sky illuminance falls below approximately 5 footcandles.

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 between 6 and 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. Vegetation removal and grading at all of the sites will be minimal, and the site 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, remove snow from the access road, and perform other services, as needed. Security services will be arranged with local authorities. 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: Jackson 1 Site (CGS-4)

The Jackson 1 site is located in the northeast quarter of the northeast quarter (NE1/4 NE1/4) of Section 35, Township 26N, Range 9E, Castor Township. The site occupies the northeastern corner of the Jackson property which is located at the southwestern corner of the intersection of State Highway F and County Road 424, 4 miles north of U.S. Highway 60. State Highway F is a 20-foot-wide, paved, all-weather road maintained by the state. The 15-foot access road would be from County Road 424, an all-weather gravel road maintained by the county.

Three-phase power would be obtained from overhead lines along the eastern side of State Highway F, 68 feet from the eastern boundary of the site. Telephone service would be obtained from overhead telephone lines along the eastern boundary of the site approximately 10 feet from State Highway F.

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

2.3 Alternative 2: Jackson 2 Site (CGS-6)

The Jackson 2 site is located in the SW1/4 SW1/4 of Section 36, Township 26N, Range 9E, Castor Township. The site occupies the northeastern corner of the Jackson property, on the south side of County Road 442, approximately 0.11 mile east of State Highway F and 3 miles north of U.S. Highway 60. State Highway F is a 20-foot-wide, paved, all-weather road, and County Road 442 is a 15-foot-wide, gravel, all-weather road. The 12-foot access road would be from County Road 442.

Three-phase power would be obtained from overhead lines parallel to County Road 442, along the northern boundary of the site. High-voltage (69 kV) power lines run parallel to the site along its southern boundary, approximately 500 feet away. Telephone service would be connected to buried cable located on the north side of County Road 442, 36 feet from the site.

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

2.4 Alternative 3: Walker Site (CGS-9)

The Walker site is located in the SE1/4 SE1/4 of Section 12, Township 25N, Range 9E, Duck Creek Township. The site occupies the northeastern corner of the Walker property and is 200 feet south of County Road 468 and adjacent to County Road 449. The site is 1 mile north of U.S. Highway 60. County Roads 449 and 468 are both 14-foot-wide, all-weather gravel roads. The 10-foot access road would be from County Road 449.

Three-phase power would be obtained from overhead lines along County Road 449, 34 feet from the eastern boundary of the site. Telephone service would be connected to buried cable running along County Road 449, adjacent to the site.

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

2.5 Alternative 4: Joseph Site (CGS-11)

The Joseph site is located in the NE1/4 SE1/4 of Section 22, Township 26N, Range 9E, Castor Township. The site occupies the southeastern corner of the Joseph property and is on the west side of County Road 467, 0.25 mile north of County Road 420. The site is 5.25 miles north of U.S. Highway 60 and 1 mile west of State Highway F. County Road 467 is an all-weather gravel road maintained by Castor Township. The 20-foot access road would be from County Road 467.

Three-phase power would be obtained from overhead lines along the east side of County Road 467, 46 feet from the eastern boundary of the site. Telephone service would be connected to buried telephone cable running along County Road 467 adjacent to the site.

Appendix B, Figure B.4 of this EA, provides a map showing the surrounding topography.

2.6 Alternative 5: Cox Site (CGS-12)

The Cox site is located in the NW1/4 SW1/4 of Section 23, Township 26N, Range 9E, Castor Township. The site occupies the northwestern corner of the Cox property and is located on the east side of County Road 467, 0.37 mile north of County Road 420. The Cox site is diagonally across County Road 467 from the Joseph site (CGS-11). The site is 5.37 miles north of U.S. Highway 60 and less than 1 mile west of State Highway F. County Road 467 is an all-weather gravel road maintained by Castor Township. The 8-foot access road would be from County Road 467.

Three-phase power would be obtained from overhead lines along the east side of County Road 467, adjacent to the site. Telephone service would be connected to buried telephone cable running along the west side of County Road 467, 33 feet from the site boundary.

Appendix B, Figure B.5 of this EA, provides a map showing the surrounding topography.

2.7 No Action Alternative

The no action alternative is deletion of the southern Missouri 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 southern Missouri. Section 3.1 of this EA describes the general characteristics of the SSA, and Sections 3.2 through 3.6 of this EA describe the unique characteristics of each CGS within the SSA. Site descriptive data was obtained during field investigations conducted in October 1989. U.S. Geological Survey 7.5 minute topographical maps were used as data sources for distances, physiographic features, and topography (USGS, 1962a-c, 1963a-b, 1976, 1978a, and 1984a-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 a circular, 250-square-mile area in Stoddard and Butler counties, centered north of the town of Dudley in the Central Lowlands physiographic province of the United States. The SSA is part of the broad alluvial plain along the southern Mississippi Valley. Crowley's Ridge, in the eastern portion of the SSA, has hilly terrain, steep slopes, and cliffs running north-northeast to south-southwest. Holly's Ridge, in the northern portion of the SSA, has similar terrain running east to west. Hilly terrain also exists in the northwestern area of the SSA, around the town of Puxico. The remainder of the SSA is relatively flat with only gradual changes in elevation, though some short, steep slopes have rises of up to 15 feet (SCS, 1985).

The geological composition of southeastern Missouri consists of flat to gently dipping sedimentary deposits overlying mid-Devonian to early Mississippian basement rock, formed approximately 350 million to 400 million years ago. These sedimentary strata are generally several hundred to several thousand feet thick. The region's sedimentary rocks date from the late-Quaternary and lower-Tertiary periods, approximately 2 million to 70 million years ago (USGS, 1970a).

Southeastern Missouri is one of the more seismically active regions in North America. The New Madrid Fault, associated with the strongest earthquake in historic times in North America, lies 24 miles to the east along the Mississippi River (Howard *et al.*, 1978; Stover *et al.*, 1979). The shock of 1812, known as the New Madrid Earthquake, is estimated to have had a Modified Mercalli (MM) intensity of XI. Accounts of earthquakes in the same area were also recorded in 1776, 1791, 1795, 1796, 1804, and 1895. The 1895 earthquake had an MM intensity of IX. Since the installation of seismographs at several locations, numerous small tremors originating in the Mississippi Valley have been recorded each year. The most notable shocks in recent years occurred in 1967 and 1976 (Rafferty, 1982).

Earthquakes of MM intensity IX can cause ground cracking, severe damage to masonry and brick buildings, shifting of wood-frame structures off foundations, and breaking of underground utilities. Earthquakes of MM intensity XI can cause widespread devastation including broad ground fissures and earth slumps, severe damage to wood-frame structures, almost universal collapse of chimneys and masonry buildings, bending of railroad rails, and failure of levees and embankments. Structures located on loosely consolidated alluvium are particularly susceptible to damage from ground failure (Stover *et al.*, 1979).

Many areas in the SSA are seismically unsound for construction (Manitakos, 1989). Because of its alluvium-based soil, southeastern Missouri has a high potential for ground liquefaction during earthquakes (SCS, 1985). To provide an operational assurance of soil stability for relay node construction, alluvium-based soils were avoided in favor of rock-based, hilly terrain. Following consultation with a local geologist, all CGSs were located in areas where the soil composition would minimize ground liquefaction and thus be seismically suitable for construction (Stewart, 1989).

No significant mineral resources of commercial value exist in the SSA (McFarland, 1989), although small sand, gravel, and clay pit operations are present in the area (SCS, 1985). These quarry operations are contained on privately owned land and are not expected to expand into other areas of the county. Sand is used for asphalt

blending and for fill. Gravel, which underlies many of the higher hills, is used for roads, parking lots, driveways, base materials, and fill. After processing, the local gravel is used for base aggregate, concrete sand and gravel, and aggregate for asphalt roads. Clay is mined north of Bloomfield and made into absorbent material (SCS, 1985).

There are no known paleontological resources in the SSA (Miller, 1989).

The soils on the CGSs belong to the Loring-Memphis-Falaya association. The principal soil type found on the CGSs is Loring silt loam, described below. The Joseph site (CGS-11) also contains a small amount of Falaya silt loam, which is described in Section 3.5 of this EA. Loring silt loam is moderately well drained, permeability is moderately slow, and surface runoff from cultivated areas is medium. The water erosion hazard is slight (SCS, 1985). The planting of Kentucky fescue grass (*Festuca arundinaceae*) is an effective technique to reduce potential water erosion of this soil type (Peters, 1989). At depths of 0 to 8 inches this soil is very strongly acidic to neutral (pH 4.5 to 7.3); at depths of 8 to 28 inches it is very strongly acidic to slightly acidic (pH 4.5 to 6.5). The seasonal high water table is perched at a depth of 2 to 3 feet during the period of heavier rains from December to March. Loring silt loam is designated prime farmland (SCS, 1985); it is not hydric (SCS, 1987).

The SSA has very little surface water. The St. Francis River defines the western boundary of Stoddard County and touches the southwestern edge of the SSA. The Castor River cuts through the northeastern section of the county and runs south along the eastern county line, but does not enter the SSA. Other natural waterways in the SSA are Delaware Creek, running east to west, and Lick Creek, running north to south in the southern portion of the SSA. Both creeks are intermittent drainages. The SSA has no lakes, but Wappapello Lake and Recreational Area is approximately 5 miles northwest of the SSA boundary, along the St. Francis River. The distances from each CGS to the nearest surface water or wetlands are given in Sections 3.2 to 3.6 of this EA.

Stoddard County is located 30 miles west of the Mississippi River, the most important water system in the region. Centuries ago, the banks of the Mississippi stretched as far west as Crowley's Ridge. As the waters receded, the region became a natural

floodplain with hickory-oak forests, swamp forests of cypress, blackgum, and associated species, and other wetlands. Settlers in the late 19th century drained the area for habitation and cultivation. With the development of the dragline dredge in 1900 came the capability of tearing out the shallow-rooted trees and digging ditches to drain the swamps. This method brought about the drainage of several thousand acres of wetlands.

In 1905 the state adopted a plan that provided for diversion of waters discharged into the area by streams from the Ozark highlands and for a series of ditches and canals within the region to carry off local water. The runoff that entered the area from the northeastern highlands was diverted into the Mississippi River by means of a diversion canal, a floodway, and a series of levees. This system begins where the Castor River flows onto the plain in northern Stoddard County and extends southeastward to the Mississippi River just below Cape Girardeau. Within the area is a system of small north-to-south ditches about 1 mile apart that lead to main canals which conduct the waters southwest out of the region and ultimately to the St. Francis River (Rafferty, 1982). Two examples of these man-made drainage ditches within the SSA are Lick Creek Ditch and Dudley Main Ditch. Drainage practices have left the lowlands of the region with an alluvium-based soil that is agriculturally rich yet seismically unsound and sensitive to flooding in some areas (SCS, 1985). The county's population is therefore concentrated on higher ground. No CGS is within a 100-year floodplain (FIA, 1979).

Groundwater is plentiful and is provided by three major sources. An alluvial aquifer underlies much of the bottomland east and west of Crowley's Ridge and produces clear, low-temperature water of high quality for agriculture. The pH reaction of this water is nearly neutral. This water is intensively used for irrigation wells, which are usually 60 to 100 feet deep, yield 1,000 gallons per minute, and are replenished each year from precipitation. The Wilcox aquifer is in the upland areas of the county between Bernie and Aquilla. This second aquifer is used primarily for domestic water supplies and, to a limited degree, for irrigation and fish farming. Most wells are about 40 to 170 feet deep. Water from a third source, the McNairy Formation, is relatively soft and low in iron content and thus is used by local municipalities, water districts, and industries. Depths of wells range from 100 to 700 feet (SCS, 1985). No data is available for copper

concentration in Stoddard and Butler counties (Laux, 1991); however, copper concentrations measured in the St. Francis River near Saco (approximately 35 miles northwest of the SSA) and in Little River ditches near Kennett (approximately 30 miles south of the SSA) average 9.6 micrograms per liter ($\mu\text{g/l}$) (Davis, 1991).

The climate of the SSA is characterized by long hot summers and rather cool winters. In winter the average temperature is 37°F and the average daily minimum temperature is 28°F. In the summer the average temperature is 78°F and the average daily maximum temperature is 90°F. An occasional cold wave brings near-freezing or even subfreezing temperatures but little snowfall, which averages only 11 inches annually. Precipitation is fairly heavy throughout the year, averaging 48 inches annually with over 50 percent of the rainfall between April and September. Prolonged periods of drought are rare. The growing season for most crops falls between April and September. In the summer the sun shines an average of 75 percent of each day and in the winter 50 percent of each day. The prevailing wind is from the south with the highest average wind speed, 12 miles per hour, in March. Severe storms, including tornados, may strike occasionally; these storms are usually of short duration and cause variable amounts of damage (SCS, 1985).

Air quality in the area is good and does not exceed the National Primary and Secondary Ambient Air Quality Standards, which have been adopted by the State of Missouri (Missouri Code of State Regulations [CSR], Title 10, CSR 10-3 and 10-6). According to the Missouri Department of Natural Resources, Stoddard County has achieved a level of air quality attainment and is not subject to any restrictive air quality measures (Ogg, 1990). 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

Virtually none of the old growth, cypress-gum forest that once flourished in the swamplands of this region still exists. Much of this woodland was depleted in the process of draining the area through a network of sloughs and canals in the late 1800s

and early 1900s. Once dried, the land and its original vegetation was cleared for cultivation through slash and burn techniques (Rafferty, 1982).

Common vegetation in Stoddard County is primarily grain and seed crops, such as corn, wheat, oats, millet, soybeans, rice, and grain sorghum. Other vegetation includes second-growth hardwood trees and conifers, such as oak, blackgum, cherry, maple, hickory, pine, spruce, cypress, cedar, and juniper. Common grasses and legumes are fescue switchgrass, orchardgrass, Indian grass, clover, alfalfa, and Korean lespedeza. Prominent weeds native to the area include ragweed, beggar's ticks, pokeweed, foxtail, and partridgepea (SCS, 1985).

Common animals in Stoddard County include deer, turkey, and squirrel, all with populations rated good to excellent for this region of the state yet considered poor compared to animal numbers in the rest of the state. Numbers of fur-bearing animals are very high in the county and primarily consist of muskrat, raccoon, opossum, mink, coyote, gray fox, beaver, and striped skunk. Quail, rabbit, and dove are also common in the area, as well as mourning dove and Korean pheasant. Stoddard County streams are home to a variety of short fish, including catfish, sunfish, bass, drum, crappie, carp, buffalofish, carpsucker, and garn (SCS, 1985).

Although Stoddard County is approximately 30 miles from the Mississippi River, birds migrating in the broad corridor of the Mississippi Flyway may pass through the area (Hansen, 1989). Common passerines and other small birds of the area include various types of sparrow, red-winged blackbird, common grackle, northern cardinal, chimney swift, blue jay, American crow, and various woodpeckers. Common raptors include the turkey vulture, red-shouldered hawk, red-tailed hawk, and barred owl. Common water birds include various herons, the Canada goose, pied-billed grebe, northern pintail, and blue-winged teal (Jones, 1990).

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 a 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 draft National Wetland Inventory maps (USFWS, 1988a, 1988b), soils data (SCS, 1985, 1987), and field investigations in October 1989 (Kroupa, 1989), none of the CGSs examined as part of this EA meets these criteria, nor do the areas within 300 feet of the CGS ground planes. Loring silt loam, the primary soil type in the CGSs, is considered a very poor potential habitat for wetland vegetation (SCS, 1985).

What little old-growth vegetation remains in Stoddard County is protected in wildlife management areas by federal and state conservation authorities (Johnson, 1989). The Mingo National Wildlife Refuge is the most extensive wetland reserve in the area; the southern edge of the refuge touches the northwestern edge of the SSA. Otter Slough State Wildlife Management Area is the largest and most widely recognized wilderness area in the SSA; it lies south of Dudley, on the southern border of the SSA. Other public areas include Holly's Ridge and Crowley's Ridge county parks, which have relatively large parcels of forest on their respective ridges. Private owners recently willed these public lands to the county for preservation (Rankon, 1989).

In compliance with Section 7 of the Endangered Species Act of 1973 as amended (16 United States Code [USC] 1531 *et seq.*, at 1536), a list of threatened and endangered species was obtained during informal consultation with the USFWS (Appendix C, Brabander, 1990, 1992, pages C-3 through C-5, C-11 and C-12 of this EA). The bald eagle (*Haliaeetus leucocephalus*) is the only threatened or endangered species noted by the USFWS and the Missouri Natural Heritage Data Base as possibly occurring in the SSA (MDC, 1989).

The bald eagle, which feeds predominantly on fish, other birds, and carrion, is generally associated with large rivers and lakes (Ehrlich *et al.*, 1988). Such habitat, and a major overwintering area for the bald eagle, is the Mississippi River, 30 miles east of the SSA (Jones, 1990). The bald eagle is known to winter near the locks and dams of the river where the water does not freeze (Hansen, 1989). In other seasons this eagle is uncommon or absent in these same places (Jones, 1990). Habitat also exists at the Mingo National Wildlife Refuge, on the northwestern edge of the SSA, also a wintering

area for the bald eagle. The CGSs are 6.5 to 11.5 miles from the Mingo National Wildlife Refuge and at least 36 miles from the Mississippi River.

Federal candidate animal species are the crystal darter (*Ammocrypta asprella*) and the Illinois chorus frog (*Pseudacris streckeri*); federal candidate plant species are the American frogbit (*Limnobium spongia*), the western fan shell (*Cyprogenia aberti*), and the Deam's rock cress (*Arabis missouriensis* var *deamii*). Recorded sightings of these species are all outside of the CGSs (MDC, 1989).

State-listed animal species that may reside in or migrate through the SSA are the Mississippi kite (*Ictinia mississippiensis*), common barn owl (*Tyto alba*), western chicken turtle (*Deirochelys reticularia miaria*), swamp rabbit (*Sylvilagus aquaticus*), stout floater (*Anodonta grandis corpulenta*), pugnose minnow (*Notropis emiliae*), bantam sunfish (*Lepomis symmetricus*), crystal darter, harlequin darter (*Etheostoma histrio*), goldstripe darter (*Etheostoma parvipinne*), and mole salamander (*Ambystoma talpoideum*). Recorded sightings of these species are all outside of the CGSs (MDC, 1989).

More than two dozen species of state-listed rare or endangered plants could occur in the SSA. These species are predominately indigenous wetland vegetation, which, due to slash and burn practices and a century of cultivation, only appear within the boundaries of the Mingo National Wildlife Refuge and Otter Slough State Wildlife Management Area. Recorded sightings of these species are all outside of the CGSs (MDC, 1989).

3.1.3 Socio-Cultural Setting

Native American tribes occupied the area from 10,000 B.C. to the middle of the 19th century, but the wandering and transient nature of many of these groups makes accurate identification of the tribes difficult (Rafferty, 1982). The principal Native Americans of southeast Missouri during their final period of occupation and the time of European exploration were the Quapaw and the Chickasaw tribes who foraged into the state on extended hunts. These tribes established well-known trails leading from their villages to hunting grounds or to other villages. Nearly all of the area's early explorers followed these primitive trails, often developed from routes made by buffalo, deer, and other wild

animals along dividing ridges or through stream valleys. The two principal trails in the area of the SSA were the Natchitoches Trail running southwest to northeast, bisecting Stoddard County, and the Shawnee Trail running north to south, cutting across the SSA's northwestern portion (Rafferty, 1982).

The first Euro-American settlements in southeastern Missouri were along the swells, ill-defined terraces, and major uplands, such as Crowley's Ridge, in the early 19th century. Many of these settlements were owned and operated by large lumber companies such as the Himmelberger-Harrison Lumber Company and the Chicago Mill and Lumber Company. As more and more timber was cleared, many of the mill-site settlements developed into farming communities. Gideon, Bernie, and Dudley are typical examples. All of the uplands were brought under cultivation, and the need for additional land created an interest in draining the adjacent lowland swamps. Advancements in dredging technology made such a feat possible and by 1905 several thousand acres of wetlands had been drained, allowing for greater settlement and agricultural development (Rafferty, 1982).

The Missouri State Historic Preservation Officer (SHPO) was consulted, as required by the National Historic Preservation Act (16 USC 470, *et seq.*). The Missouri SHPO recommended that a cultural resources survey be conducted to identify archaeological, historical, or architectural properties that are listed, eligible, or potentially eligible for listing on the National Register of Historic Places (Appendix C, Weichman, 1989, page C-7 of this EA). Later, the Missouri SHPO determined that no historic structures survey was necessary due to the low probability of significant architectural resources occurring in the project area (Appendix C, Weichman, 1991, page C-10 of this EA).

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 within 1.5 miles of a CGS are potentially subject to adverse visual impacts from the relay node facility. The archival data search, part of the cultural resources work, revealed that no properties listed or eligible for listing on the NRHP are within 1.5 miles of any CGS. Only three sites in Stoddard County have been listed on the NRHP: Rich Wood Archaeological Site, the Mingo National Wildlife Refuge Archaeology District, and the Stoddard County Court House. The Stoddard

County Court House in Bloomfield is the only historic property in the SSA, but it is more than 1.5 miles from any CGS (NRHP, 1989).

A Phase I archaeological survey was conducted on four of the five CGSs during the winter of 1990. (The Cox site, CGS-12, was withdrawn prior to this survey.) Each site was surveyed by a professional archaeologist qualified in the State of Missouri using pedestrian transects at 5-meter (16-foot) intervals. The Jackson 1 site (CGS-4) was found to contain no archaeological remains. The Jackson 2 (CGS-6), Walker (CGS-9), and Joseph (CGS-11) sites were identified as having archaeological resources of potential significance. The previously unrecorded prehistoric artifacts from these three sites consist of lithic debris (scatters and flakes in CGS-6; flakes in CGS-9; and core, scatter, and flakes in CGS-11) with prehistoric artifact density ranging from 0.005 to 0.014 items per square meter. Observation of *in situ* artifacts found in insignificant areas of exposed subsoil caused by water erosion suggests that at least parts of the sites may retain some degree of their original integrity. These prehistoric artifact assemblages indicate that the areas were used as limited-function, short-term campsites, or as a series of campsites, at an unknown time. Thus, at the Phase I level of investigation, all three archaeological sites are potentially eligible for listing on the NRHP (TRS, 1990).

In compliance with the American Indian Religious Freedom Act of 1978 (42 USC 1996), the Bureau of Indian Affairs (BIA) was contacted and information was requested about the presence of traditional, religious, or sacred sites in the SSA. The BIA representative from the regional office in Anadarko, Oklahoma said that no federally recognized tribes live in Missouri today. He recommended writing to three tribes that had historically been in the area: the Quapaw, the Chickasaw, and the Osage (Parry, 1992). Representatives of these tribes were contacted by letter with regard to the presence of any known traditional, religious, or sacred sites that could be affected by construction of the proposed tower. The Chickasaw Nation responded that they have no concerns about the GWEN project in southern Missouri (Appendix C, Anoatubby, 1992, page C-13 of this EA). No response to letters or several attempts at phone calls has been received from the other tribes.

Land use in the area is predominantly agricultural. In 1982, 80 percent of the land area in Stoddard County was used for agricultural farming (Census Bureau, 1988). The primary crops are corn, wheat, oats, millet, soybeans, and grain sorghum. Rice, introduced only recently, has become an increasingly popular cash crop because of its high market value. Crop-rotation farming and row farming are the most common agricultural practices. Some farmers also engage in livestock production, but it is not significant within the local economy. Agricultural development is concentrated in the southern portion of the county, primarily because of its flat terrain and alluvium-based soil. Since alluvium-based soil is agriculturally rich, yet seismically unsound for construction and subject to flooding (SCS, 1985), residents tend to live in the north central part of the county and to farm in the southern part.

None of the sites has a zoning designation and GWEN development would be compatible with the surrounding land use (Bollinger, 1989).

Outside of the area's towns, the density of residential structures is low, about two to three houses per square mile. The main east-west road through the area is U.S. Highway 60, a two-lane paved road. The main north-south road is State Highway 25, also a two-lane paved road.

Sources of ambient noise are limited primarily to the operation of farm equipment and to traffic. As described in Section 3.5.3, beginning on page 3.5-1 of the FEIS, local ordinances typically set maximum noise level limits at 70 to 75 dBA for land under agricultural use. Stoddard County has no local noise ordinance (SCCO, 1989).

The 1990 population in Stoddard County was 28,895 (Census Bureau, 1990). The largest developments within the SSA are the towns of Dexter (population 7,043) and Bloomfield (population 1,795), the Stoddard County seat (Rand McNally, 1989). Both towns are located on Crowley's Ridge on the eastern edge of the SSA. The only other concentrations of inhabitants are in the town of Puxico (population 633) on the northwestern edge of the SSA, and the village of Dudley (population 287) in the south central portion of the SSA (Rand McNally, 1989).

The county has little industry other than agriculture and its related services. The construction industry is the only other major employer (Census Bureau, 1987). Per capita income for Stoddard County was \$8,648 in 1984, well below the state figure of \$12,075 and the national figure of \$12,772. In 1986, 9.7 percent of the labor force was unemployed, higher than the state figure of 6.1 percent for that year, and the national figure of 7.0 percent (Census Bureau, 1988).

Hunting is the most prominent recreational activity in the area. Additional recreational resources are primarily confined to the Otter Slough State Wildlife Management Area, which provides bird watching and nature walks. About 5 miles northwest of the SSA is Wappapello Lake and Recreational Area which provides picnicking, camping, and water sports. Other than in these specifically designated areas, most recreational activities occur in or near the area's small towns (Martin, 1989).

The visual setting is rural in character, with fairly level topography except for Holly's Ridge and Crowley's Ridge. Landscape patterns tend to be simple geometric shapes, which are evident in the local road system that divides the land into 1-mile square sections and in the row crops of rice, wheat, milo, corn, and soybeans. Except for views that include towns, the complexity of the skyline is generally low, as defined in Section 4.8.1.3, page 4.8-10 of the FEIS, although farmsteads and their associated windbreaks provide variation on a local level. Tree lines along rivers, streams, and drainage ditches are common. Tall structures such as silos, grain elevators, and water towers are also common and are generally concentrated in or near towns.

3.2 Alternative 1: Jackson 1 Site (CGS-4)

The Jackson 1 site is on slightly sloping land. The 2 to 3 percent slope is from the northeast corner to the southwest corner and is terraced to prevent soil erosion. The terracing is in the northeast quadrant of the site and resembles a series of four or five quarter circles. The remaining quadrants of the site are flat. The soil type found at this site is Loring silt loam. The soil's structure and characteristics, as well as pH level, drainage, and seasonal high water table are discussed in Section 3.1.1 of this EA.

The site contains prime agricultural land which has been extensively cultivated in the past and at the time of the field investigation was used for growing soybeans, which were planted in rotation with winter wheat. The site was plowed and contained no trees. The surrounding land is used for agriculture, grazing, or is lightly wooded.

The site is dry, with no standing water. According to USGS topographical maps, the site lies between two intermittent streams, one 0.5 mile northwest and the other 600 feet south. A small pond lies 200 feet from the southwest corner of the site, 300 feet from the buried copper ground plane. A man-made drainage ditch on the northwest corner of the site runs southwest and cuts through the western boundary line to effectively sever a portion of the site. This ditch is designed only to handle rainwater runoff. After directing runoff under County Road 424 and across the southwestern corner of the site, the ditch ends and the runoff dissipates into a field. It does not connect to any stream and is therefore not considered a water of the United States under the Clean Water Act. Ultimate drainage is into Lick Creek Ditch, 3 miles to the southeast.

The proposed site is about 8 miles north of the Otter Slough State Wildlife Management Area and 8.5 miles southeast of the Mingo National Wildlife Refuge.

During the Phase I archaeological survey, no archaeological resources were found (TRS, 1990). The site is 6 miles from the nearest national or state historical property, the Stoddard County Court House in Bloomfield (NRHP, 1989).

The nearest residential community is Dexter, over 5 miles away. The terrain between Dexter and the site is wooded and hilly.

3.3 Alternative 2: Jackson 2 Site (CGS-6)

The Jackson 2 site is elevated from County Road 442 and has a slight hill in the middle that slopes north 2.5 percent and south 3.5 percent, creating a natural drainage. The soil type found at this site is Loring silt loam. The soil's structure and characteristics, as well as pH level, drainage, and seasonal high water table are discussed in Section 3.1.1 of this EA.

The site contains prime agricultural land and has no trees. The land has been extensively farmed in the past and at the time of the field investigation was under soybean cultivation. Adjacent land use is agricultural with no rare or old growth in the area. There are few trees adjacent to the site but the surrounding property has tree lines.

The nearest surface water is an intermittent stream 200 feet north of the site, about 280 feet from the copper ground plane. A man-made aesthetic pond inhabited by barnyard ducks and geese is located 200 feet from the southeastern corner of the site approximately 320 feet from the copper ground plane. This pond is also designated a palustrine unconsolidated bottom wetland (USFWS, 1988b).

The site is 7.5 miles north of the Otter Slough State Wildlife Management Area and about 10 miles southeast of the Mingo National Wildlife Refuge.

The site contains archaeological resources of potential significance, including scatter and flakes, as discussed in Section 3.1.3 of this EA. These resources are potentially eligible for listing on the NRHP (TRS, 1990). The site is over 4 miles from the nearest national or state historic property, the Stoddard County Court House in Bloomfield (NRHP, 1989).

The nearest residential community is Dexter, 4 miles southeast of the site. The intervening land is lightly wooded and hilly. The site is visible from State Highway F, located 600 feet west of the site boundary.

3.4 Alternative 3: Walker Site (CGS-9)

The Walker site is on relatively flat land that slopes less than 2 percent from east to west. The soil type found at this site is Loring silt loam. The soil's structure and characteristics, as well as pH level, drainage, and seasonal high water table are discussed in Section 3.1.1 of this EA.

At the time of the field investigation the site was under the Conservation Reserve Program (CRP) and had not been cultivated in recent years, although it has been extensively farmed in the past. Although the site does contain prime agricultural land, it was fallow with grass cover. The surrounding land is used for agriculture, grazing, or is lightly wooded. The site had no trees, nor does it contain any rare or old-growth vegetation.

The nearest surface water is an intermittent stream 280 feet from the southeast corner of the site, 400 feet from the buried copper ground plane.

The site is about 6 miles north of the Otter Slough State Wildlife Management Area and 11.5 miles southeast of the Mingo National Wildlife Refuge.

The site contains archaeological resources of potential significance, including flakes, as discussed in Section 3.1.3 of this EA. These resources are potentially eligible for listing on the NRHP (TRS, 1990). The closest national or state historic property, the Stoddard County Court House in Bloomfield, is over 7 miles to the northeast (NRHP, 1989).

The nearest residential community is Dexter, 3.4 miles southeast. The land between Dexter and the site is wooded and at a slightly higher elevation than both Dexter and the site. One residence is within 50 feet of the site. The site is located 1.3 miles to the north of U.S. Highway 60.

3.5 Alternative 4: Joseph Site (CGS-11)

The Joseph site is on relatively flat land with a slight rise in the center. The site slopes to the southeast by 3.5 percent and to the southwest by 3.5 percent. The soil types on this site are Loring silt loam and a small amount of Falaya silt loam at the southwest corner. The soil characteristics of Loring silt loam are discussed in Section 3.1.1 of this EA. Falaya silt loam is a somewhat poorly drained soil with moderate permeability, slow surface runoff, and a slight erosion hazard. It is very strongly acid to strongly acid (pH 4.5 to 5.5), with a seasonal high water table of 1 to 2 feet during wet periods. It is designated prime farmland (SCS, 1985) and is hydric (SCS, 1987).

The site contains prime agricultural land and at the time of the field investigation was under soybean cultivation. The site has been extensively farmed in the past and no rare or old-growth vegetation remains. A thin line of trees stretches along the site's southern property line, and trees ranging from 5 to 25 feet in height are present 35 feet from the southern boundary. The land around the site is primarily used for agriculture or grazing and has wooded areas along property lines.

The nearest surface water is an intermittent stream 800 feet south of the site. Lick Creek Ditch, a man-made drainage slough, is approximately 1 mile west of the site. The east side of the site has a dry, abandoned, man-made watering hole that will require filling.

The site is about 10 miles north of the Otter Slough State Wildlife Management Area and 6.5 miles southeast of the Mingo National Wildlife Refuge.

The site contains archaeological resources of potential significance, including core, scatter, and flakes, as discussed in Section 3.1.3 of this EA. These resources are potentially eligible for listing on the NRHP (TRS, 1990). The site is more than 6 miles from the nearest national or state historic property, the Stoddard County Court House in Bloomfield (NRHP, 1989).

The nearest residential community is Puxico, located 6 miles to the northwest.

3.6 Alternative 5: Cox Site (CGS-12)

The Cox site is on relatively flat land with a slight rise in the southeastern corner. The site slopes to the northwest by 1.5 percent overall. The soil type found at this site is Loring silt loam. The soil's structure and characteristics, as well as pH level, drainage, and seasonal high water table are discussed in Section 3.1.1 of this EA.

The site contains prime agricultural land and at the time of the field investigation the western three-quarters was under soybean cultivation. The remaining eastern quarter was a grassy field. A thin line of trees stretches along the site's northern property line. The land around the site is primarily used for agriculture and grazing.

The nearest surface water is an intermittent stream 800 feet from the northeast corner of the site. Lick Creek Ditch, a man-made drainage slough, is approximately 1 mile west of the site.

The site is about 10 miles north of the Otter Slough State Wildlife Management Area and 6.5 miles southeast of the Mingo National Wildlife Refuge.

Phase I archaeological studies were not conducted on this site, as the site was withdrawn before study work was completed. The site is more than 6 miles from the nearest national or state historic property, the Stoddard County Court House in Bloomfield (NRHP, 1989).

The nearest residential community is Puxico, located 6 miles to the northwest.

4.0 ENVIRONMENTAL CONSEQUENCES OF ACTION ALTERNATIVES

This section discusses the potential impacts of the GWEN project on the environmental setting of the five CGSs in southern Missouri. Several impacts that would be common to some or 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 4.6 of this EA. As indicated in Sections 4.3 through 4.5 of this EA, the project could have significant impacts to archaeological resources if built on the Jackson 2 (CGS-6), Walker (CGS-9), or Joseph (CGS-11) site. There could also be significant impacts on surface water at the Jackson 2 site. The potential for impacts to archaeological resources at the Cox site (CGS-12) is unknown because the site was withdrawn before the cultural resources survey was undertaken. There would be no significant impacts on the Jackson 1 site (CGS-4), as indicated in Section 4.2 of this EA.

4.1 Common Features

Presented below is information on the physical, biological, and socio-cultural impacts common to some or all of the action alternatives.

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 500 square feet of land at any site and would be along the previously graded public highway right-of-way.

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 to **mineral resources** would be minor, as indicated in Section 4.1.1.4, page 4.1-2 of the FEIS. No significant mineral resources of commercial value exist in the SSA (McFarland, 1989), although small sand, gravel, and clay pit operations are present in the area (SCS, 1985). If any mineral resources are present under any site, development of that 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 impact.

Impacts on **paleontological resources** are not anticipated because no significant paleontological resources are known to occur on any CGS (Miller, 1989). However, if any fossils are found during construction, work that might affect them will be suspended while the Missouri State Geologist's Office is notified and the significance of the find is evaluated.

Erosion and increase in storm water runoff would not be significant. After construction, the site would be replanted with Kentucky fescue grass (*Festuca arundinaceae*), an effective means of reducing potential water erosion of Loring soils (Peters, 1989). All sites have slopes of less than 4 percent, so any required grading to level the site would be minimal.

None of the sites is within a **100-year floodplain** (FIA, 1979).

A maximum of 11 acres of **prime farmland** would be removed from production for the duration of the project. However, the impacts of GWEN development on agricultural land would not be significant, as discussed in Section 4.1.13, page 4.1-2 of the FEIS.

Impacts on **drinking water** are not 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 µg/l and this represents 2 percent of the maximum allowable copper concentrations permitted by the State of Missouri for raw water sources for potable water supply (Missouri CSR, Title 10 CSR 20-7). The Missouri 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 could be significant at the Jackson 2 site (CGS-6) because this site has water within 300 feet of the ground plane, as discussed in Section 4.3 of this EA. Impacts are not expected on the other four CGSs because the ground plane of these sites is at least 300 feet from surface water or wetlands (FICWD, 1989; Kroupa, 1989; SCS, 1985, 1987; USFWS, 1988a, 1988b). Although the Jackson 1 site (CGS-4) has a man-made drainage ditch at one corner of the site, this ditch is not considered a water of the United States, so there would be no impacts, as discussed in Section 4.2 of this EA.

As discussed in Section 4.2.4.1, page 4.2-7 of the FEIS, in acidic soils or where the seasonally high water table is within 3 feet of the ground plane, a setback of 300 feet from surface water would reduce the maximum increase in copper concentrations to less than 1 to 2 µg/l under worst-case assumptions. Assuming that the 9.6 µg/l background concentration of copper in the St. Francis River near Saco (approximately 35 miles northwest of the SSA) and in Little River ditches near Kennett (approximately 30 miles south of the SSA) (Davis, 1991) is indicative of surface water in the region, the addition of 1 to 2 µg/l to this background concentration is within the State of Missouri's maximum copper concentrations of 20 µg/l for water protected for wildlife, fish, aquatic, and semi-aquatic life, and secondary human contact (Missouri CSR, Title 10 CSR 20-7).

Impacts on **air quality** would not be significant. Temporary but insignificant increases in air pollutant emissions would occur during construction, primarily from greater use of heavy machinery than would be required in normal farming operations. 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 Missouri (Ogg, 1990).

4.1.2 Biological

The only federally listed **threatened or endangered species** cited by the USFWS as potentially occurring in the SSA is the bald eagle, and the greatest potential impact to this species is from collision with the GWEN tower. At the recommendation of the Missouri office of the USFWS, the Air Force will implement two measures to reduce the potential for impact. First, a dual lighting system will be installed that employs a white strobe light during the day and a red blinking light at night, as discussed in Section 2.1.2 of this EA. Second, 42 nine-inch yellow aviation marker balls will be placed on the guy wires of the tower to make the wires more visible to birds in flight. The marker balls will be international yellow and will be placed in an alternating pattern so that they appear to a bird in flight to be placed continuously over the facility. With the proposed measures to enhance visibility of the guy wires and the tower, the USFWS concurs that the tower would not pose a significant hazard to the bald eagle or any other plant or animal species that are candidates for federal listing (Appendix C, Brabander, 1991, page C-6 of this EA).

No species listed by the State of Missouri as rare, threatened, or endangered, and no unique biological communities would be affected (Dieffenbach, 1990).

Bird collisions with the tower by other resident or migratory birds may occur but are not expected to be significant. Section 4.4.1.5, page 4.4-5 of the FEIS states that most bird collisions occur in adverse weather conditions when the visibility of man-made structures is obscured and birds may be 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). Annual losses due to collisions with towers

represent approximately 0.013 to 0.016 percent of the total estimated annual avian mortality (Avery, 1982). The siting process aims to minimize the probability of collisions by avoiding areas with high concentrations of bird flight activity, such as feeding and nesting habitats, prominent topographical features that could serve as navigational aids, known migration corridors, and raptor roosting areas.

The Otter Slough State Wildlife Management Area is 6 to 10 miles from each CGS, and the Mingo National Wildlife Refuge is 6.5 to 11.5 miles from each CGS. All sites are therefore outside the primary foraging zone that surrounds the refuges. Birds enter and leave the refuges from all directions and show no preferred migratory path. To assure that the probability of collisions is minimal, however, the proposed tower sites are located away from topographical features such as high ridges and waterways that could concentrate avian flight lanes (Hansen, 1989). There are no natural perennial streams in the SSA with riparian habitat that might attract birds. The two major man-made drainage ditches in the SSA lack such riparian woodlands or wetland vegetation and would be unlikely to be heavily used by birds. Although the Mississippi River is a major avian flyway, it is over 30 miles to the east of the SSA, and the GWEN project would not pose a significant hazard to migratory birds.

In addition, the marker balls and dual lighting system installed for protection of threatened and endangered species would also reduce potential impacts to migratory birds.

The USFWS has also suggested that any overhead power lines associated with the project be raptor-proofed (Appendix C, Brabander, 1990, pages C-3 to C-5 of this EA). Installation and upgrading of the GWEN power lines in southern Missouri will be done in accordance with the guidelines provided by the Raptor Research Foundation, Inc. (Olendorff *et al.*, 1981); wires will be insulated and artificial perches will be constructed above transformers to provide higher and safer places for birds to sit.

Impacts on **wildlife and wildlife habitat** would not be significant. Each CGS is an agricultural field that has row crops or is fallow under the CRP. Each site is far from lakes and perennial streams that could attract wildlife, and each is far from woodlands

that could provide cover for big game. None of the sites contains federal jurisdictional wetlands (Kroupa, 1989; SCS, 1985, 1987; USFWS, 1988a, 1988b). Consequently, no critical or exceptionally valuable wildlife habitats would be at risk.

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 through agreements with local police officials to 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. All candidate sites are unzoned agricultural land, and a GWEN facility would be compatible with the surrounding land use (Bollinger, 1989). Because the project would not significantly reduce wildlife habitats, it would have little effect on recreational hunting. 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 back-up 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 Jackson 1 (CGS-4), Jackson 2 (CGS-6), Joseph (CGS-11), and Cox (CGS-12) sites have no residences within 50 feet of the site boundary, so noise impacts at these sites would be minimal. Potential impacts to the residence next to the Walker site (CGS-9) are discussed in Section 4.4 of this EA.

Impacts on **public health and safety** would not be significant, as discussed in Sections 4.11 and 4.12, 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 described 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** on the Jackson 1 site (CGS-4) would not be significant. If any archaeological resources are found on this site during construction, work that might affect them will be suspended while the Missouri SHPO is notified in accordance with the provisions of 16 USC 470, *et seq.*, at 470f. Impacts on archaeological resources are unknown on the Cox site (CGS-12) because it was withdrawn before the archaeological survey was undertaken. Impacts on archaeological resources on the other three sites (Jackson 2, CGS-6; Walker, CGS-9; and Joseph, CGS-11) could be significant. Based on Phase I archaeological survey

findings, these three sites have archaeological resources that are potentially eligible for listing on the NRHP. The Missouri SHPO concurs with the findings of the study and recommends that these archaeological sites be avoided or that a Phase II survey be undertaken to ascertain NRHP eligibility (Appendix C, Weichman, 1990, pages C-8 and C-9 of this EA). The Air Force has decided not to conduct a Phase II intensive survey. Therefore, the significance of any archaeological resources and their potential eligibility for inclusion on the NRHP remain unknown. Construction will not occur on any of these three sites until additional survey work and documentation is accomplished and the results are coordinated with the Missouri SHPO.

The GWEN program would have no significant impact on **historic properties**. The literature review of the cultural resources survey identified no properties as listed or eligible for listing on the NRHP within 1.5 miles of the CGSs (NRHP, 1989). The Missouri SHPO determined that no historic structures survey was required to identify properties that might be potentially eligible for listing on the NRHP due to the low probability of significant architectural resources occurring in the project area (Appendix C, Weichman, 1991, page C-10 of this EA).

Significant impacts to **Native American traditional, religious, or sacred sites** are not anticipated. At the recommendation of the BIA, the Quapaw, Chickasaw, and Osage were contacted (Parry, 1992). The Chickasaw Nation responded that they have no concerns about the GWEN project in southern Missouri (Appendix C, Anoatubby, 1992, page C-13 of this EA). No response to letters or several attempts at phone calls has been received from the other tribes.

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. This FEIS discussion is based on a tower without aviation marker balls on the guy wires. However, field analysis indicates that the addition of aviation marker balls does not increase the visibility of the tower beyond 0.25 mile and hence would not alter the results of the visual analysis (McGee, 1991). 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 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 the 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.

Visual impacts would not be significant because there are no high or medium sensitivity views within 1.5 miles of any of the CGSs. USGS topographic maps and a windshield survey were used to determine that there were no such views within 1.5 miles of the CGSs.

4.2 Alternative 1: Jackson 1 Site (CGS-4)

No significant impacts are expected.

Impacts to **surface water** would not be significant. A man-made drainage ditch originating at the site's northwestern corner is designed to handle rainwater runoff. The ditch ends at the southwestern corner of the site and the runoff dissipates into a field. Since the ditch does not connect to any stream, it is therefore not considered a water of the United States under the Clean Water Act. Because of this, standards for copper leachate do not apply. All other surface water is more than 300 feet from the buried copper ground plane.

Impacts on **archaeological resources** would not be significant because no archaeological resources were found during the Phase I survey (TRS, 1990).

4.3 Alternative 2: Jackson 2 Site (CGS-6)

Significant impacts are expected.

Impacts on **surface water or wetlands** that support aquatic plants and animals could be significant because an intermittent stream occurs 280 feet north of the ground plane, the soils are acidic, and the depth to the seasonally high water table is 2 to 3 feet from the surface for part of the year. Under these conditions, copper could leach into the stream and could cause a significant impact. All other surface water is more than 300 feet from the buried copper ground plane.

Impacts on **archaeological resources** could be significant. This site contains archaeological resources that are potentially eligible for listing on the NRHP (TRS, 1990), as discussed in Section 3.1.3 of this EA. If they were to become eligible and if no mitigation measures were taken, the impact of the GWEN project on these resources could be significant.

4.4 Alternative 3: Walker Site (CGS-9)

Significant impacts are expected.

Impacts on **archaeological resources** could be significant. This site contains archaeological resources that are potentially eligible for listing on the NRHP (TRS, 1990), as discussed in Section 3.1.3 of this EA. If they were to become eligible and if no mitigation measures were taken, the impact of the GWEN project on these resources could be significant.

One residence would be as close as 40 feet from the northern site boundary. To minimize **noise** impacts to this residence, the BUPG would be located at least 100 feet from the residence with its exhaust side facing away from the structure. This would ensure that noise levels were below 65 dBA, the residential standard established in Section 3.5.3, page 3.5-2 of the FEIS.

4.5 Alternative 4: Joseph Site (CGS-11)

Significant impacts are expected.

Impacts on **archaeological resources** could be significant. This site contains archaeological resources that are potentially eligible for listing on the NRHP (TRS, 1990), as discussed in Section 3.1.3 of this EA. If they were to become eligible and if no mitigation measures were taken, the impact of the GWEN project on these resources could be significant.

4.6 Alternative 5: Cox Site (CGS-12)

Impacts are unknown.

Impacts to **archaeological resources** have not been determined. This site was withdrawn by the Government due to litigation surrounding ownership of this property before the Phase I archaeological survey was undertaken. For that reason, the site was not surveyed for archaeological resources.

4.7 No Action Alternative

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

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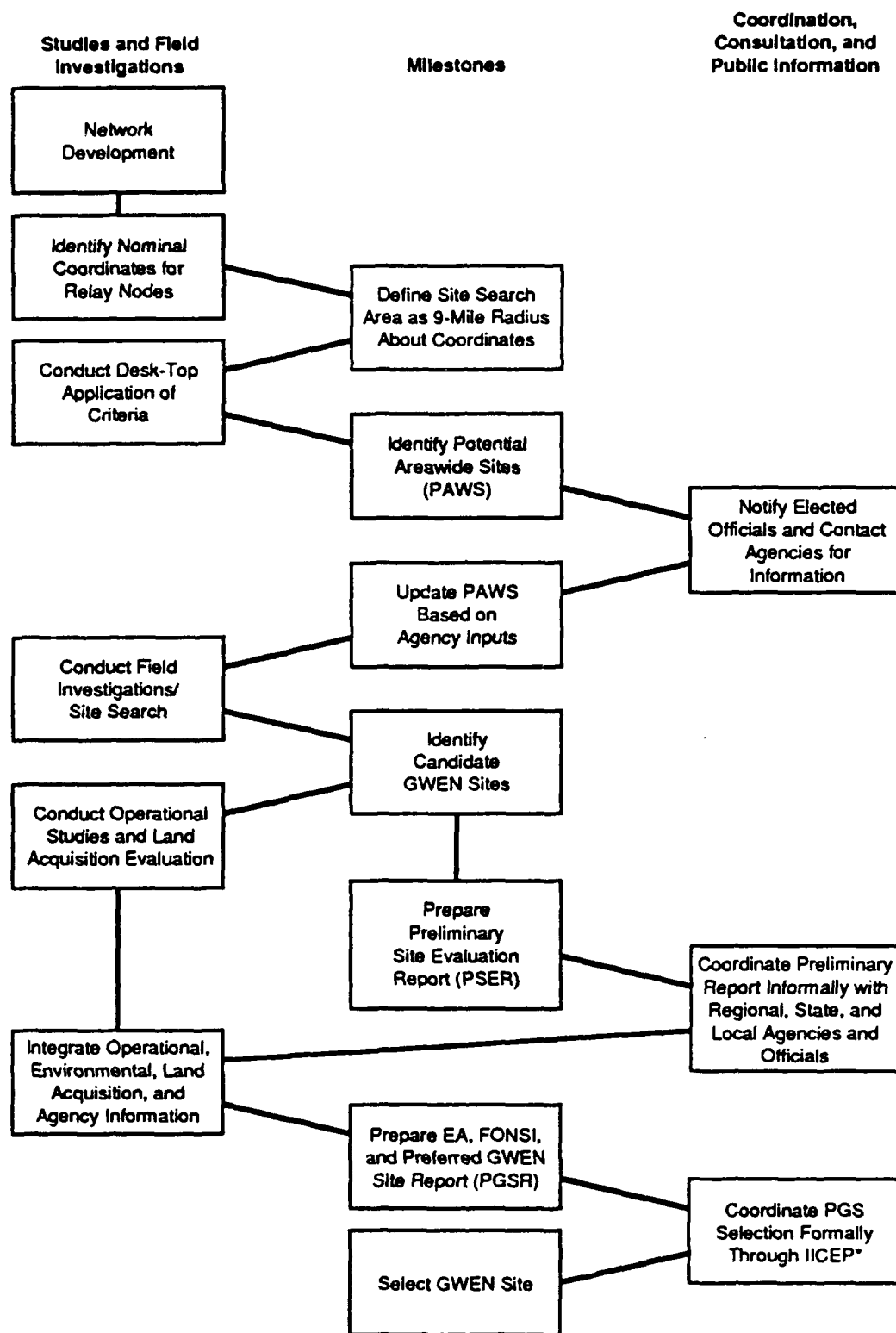
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APPENDIX A

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 five 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 and 5-14 of the FEIS.



*IICEP = Interagency/Intergovernmental Coordination for Environmental Planning.

FIGURE A.1 GROUND WAVE EMERGENCY NETWORK SITE SELECTION PROCESS

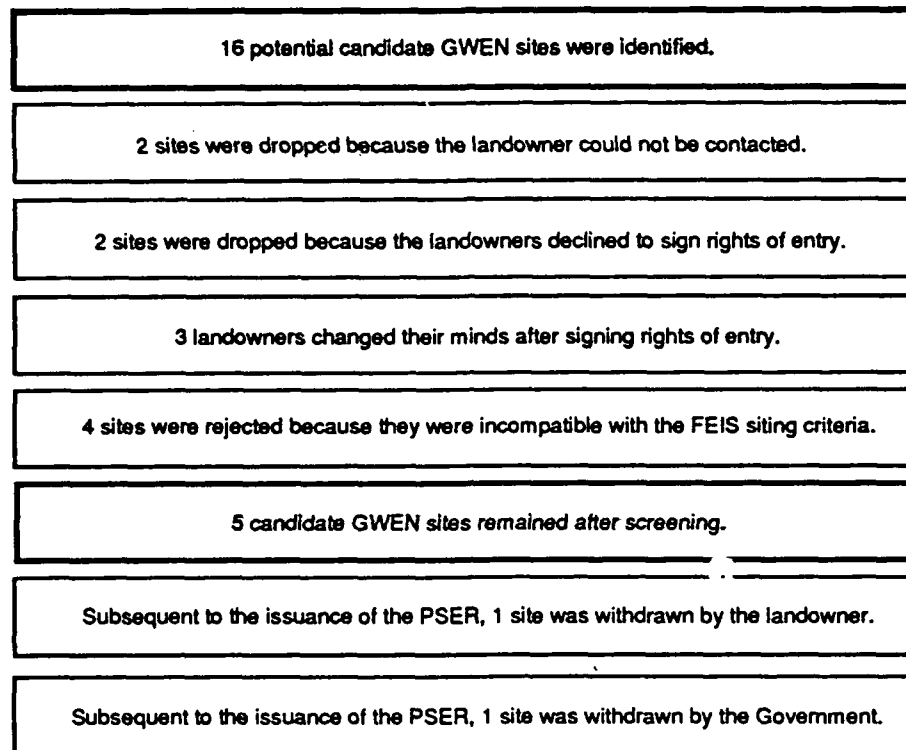


FIGURE A.2 RESULTS OF USING FEIS SITING CRITERIA TO
SCREEN POTENTIAL CANDIDATE GWEN SITES IN
THE SOUTHERN MISSOURI SITE SEARCH AREA

APPENDIX B

TOPOGRAPHIC SETTINGS OF CANDIDATE GWEN SITES

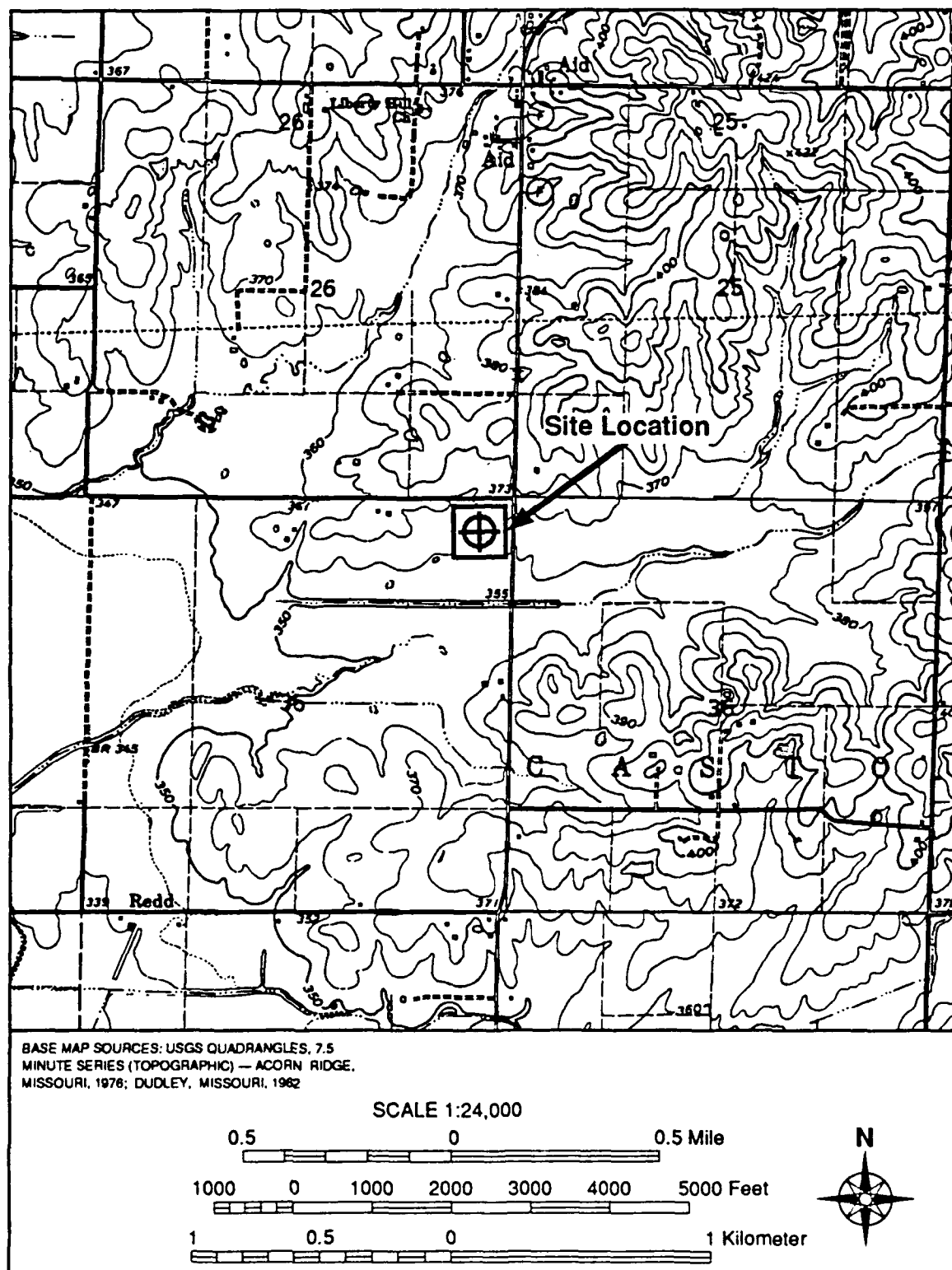


FIGURE B.1 TOPOGRAPHIC SETTING OF THE JACKSON 1 SITE (CGS-4)

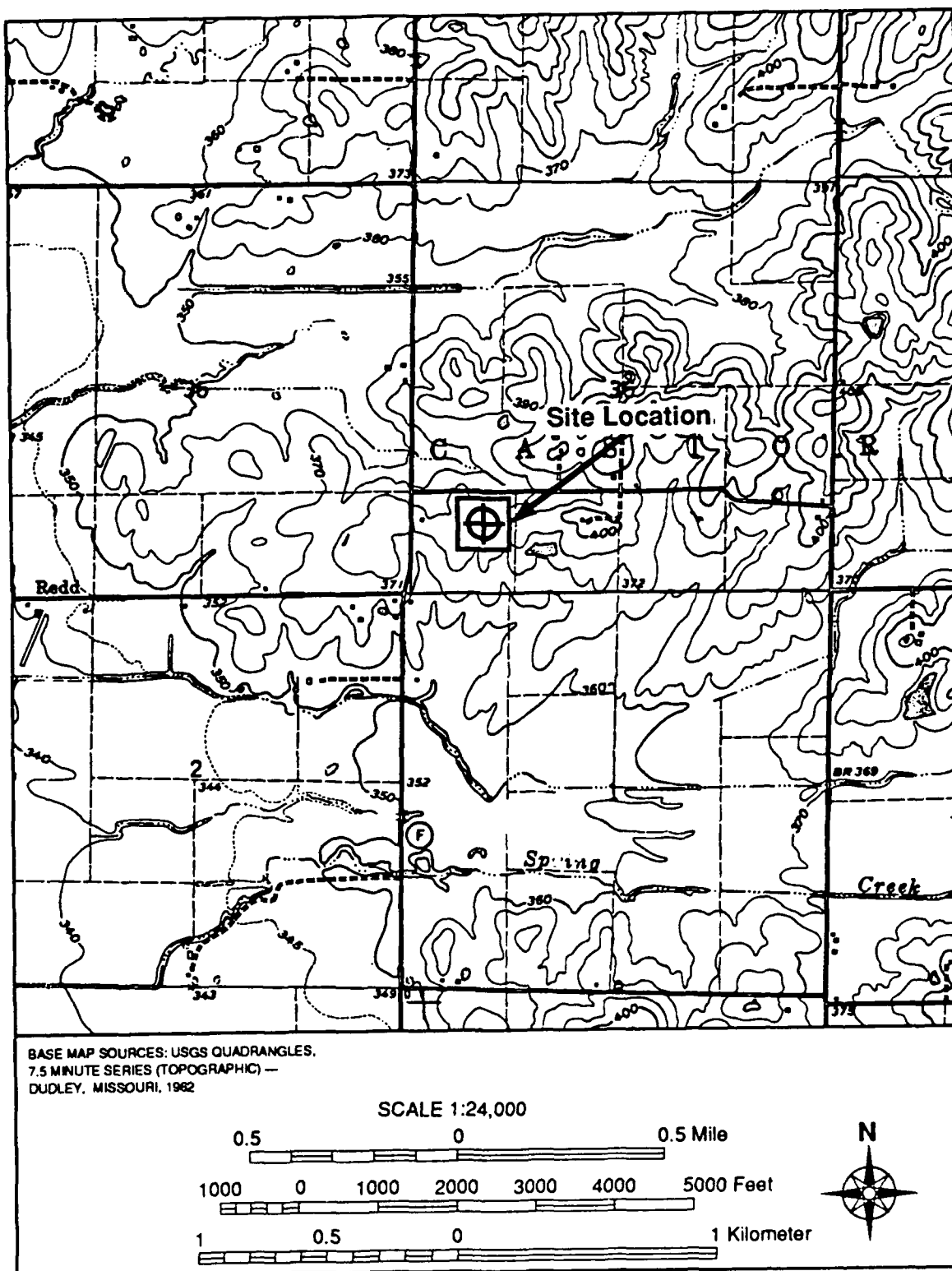


FIGURE B.2 TOPOGRAPHIC SETTING OF THE JACKSON 2 SITE (CGS-6)

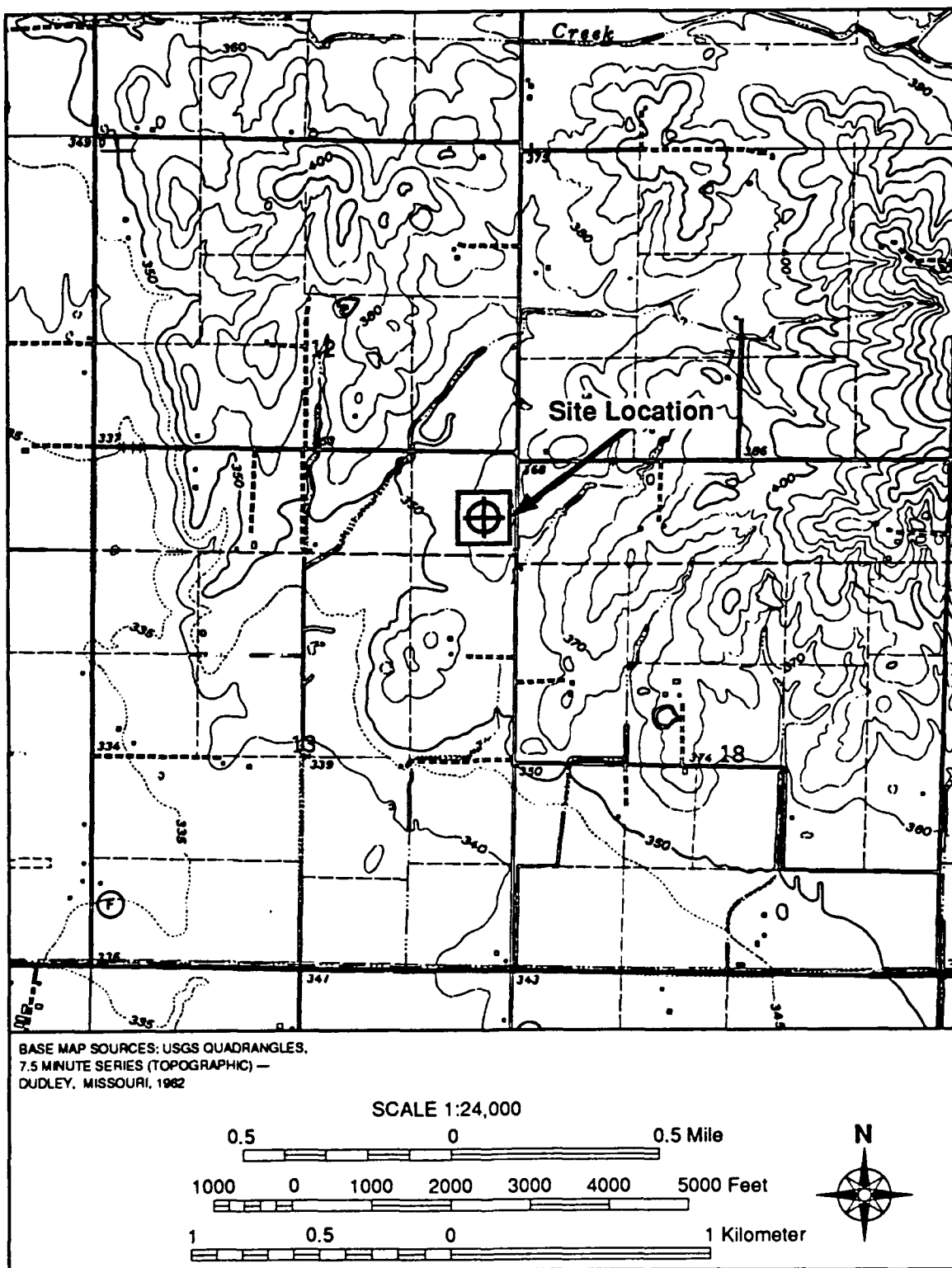


FIGURE B.3 TOPOGRAPHIC SETTING OF THE WALKER SITE (CGS-9)

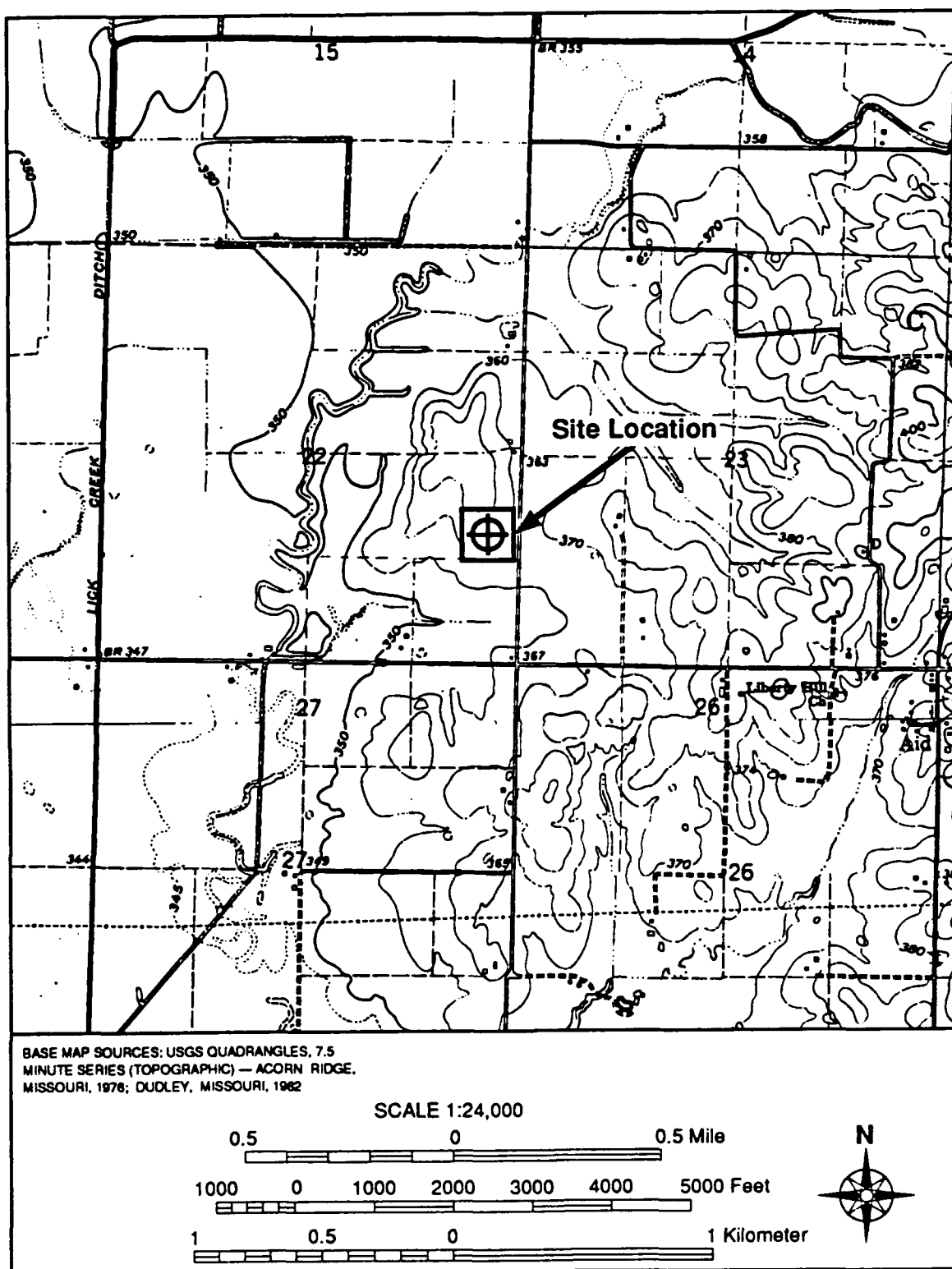


FIGURE B.4 TOPOGRAPHIC SETTING OF THE JOSEPH SITE (CGS-11)

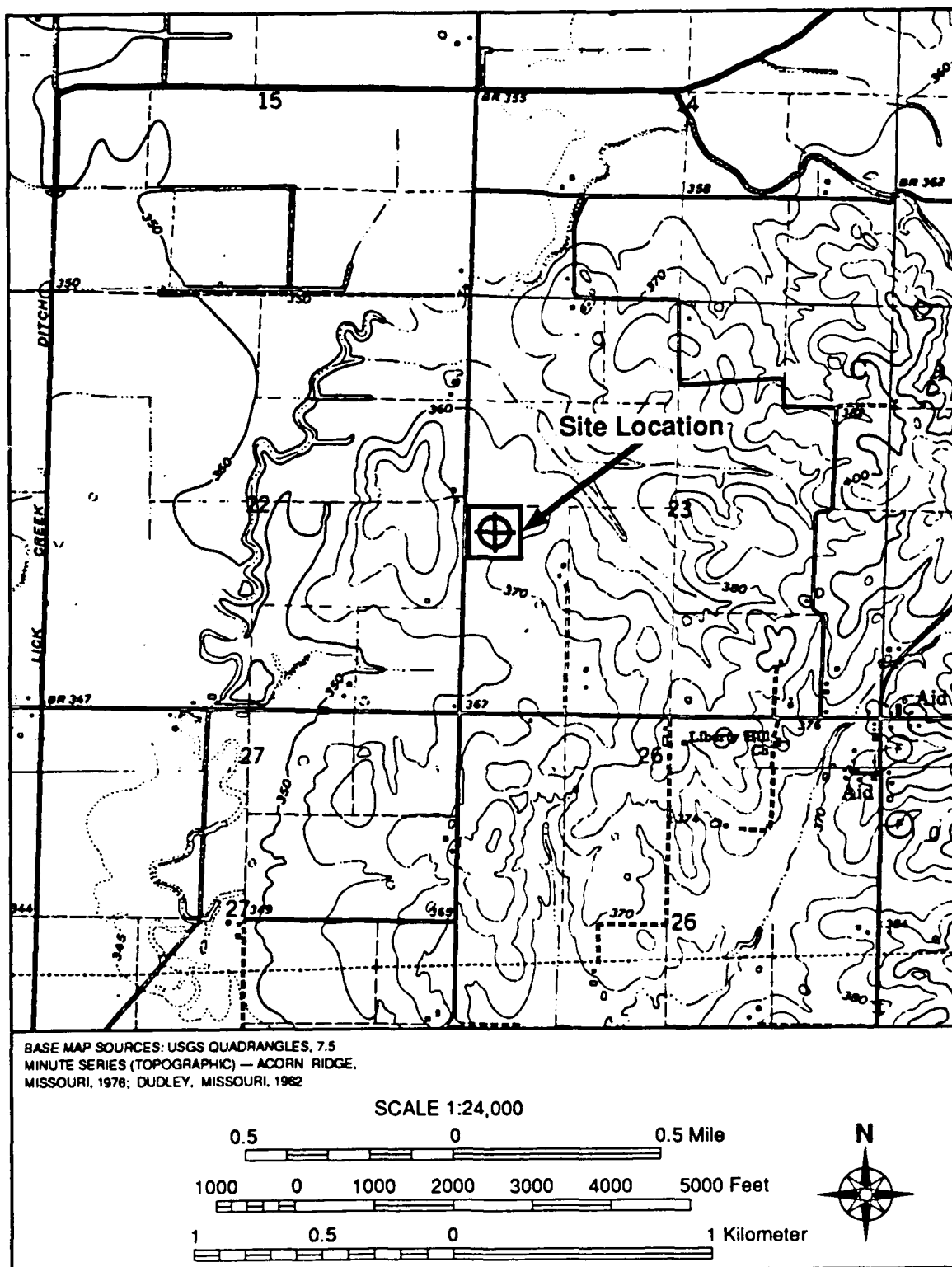


FIGURE B.5 TOPOGRAPHIC SETTING OF THE COX SITE (CGS-12)

APPENDIX C

CORRESPONDENCE

CORRESPONDENCE

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

<u>Individual</u>	<u>Agency</u>	<u>Date</u>	<u>Response</u>
J. Brabander, Field Supervisor	U. S. Dept. of the Interior, Fish and Wildlife Service	06-12-90	Attached
		08-27-91	Attached
		05-14-92	Attached
		12-22-92	Attached
M. Weichman, Sr. Archaeologist	State of Missouri, Dept. of Natural Resources, Division of Parks, Recreation, and Historic Preservation	10-26-89	Attached
		03-27-90	Attached
		05-14-90	Attached
		09-09-91	Attached
A. Anoatubby, Governor	Chickasaw Nation, Ada, Oklahoma	08-21-92	Attached
W.H. Mathews, Jr., Chairperson	Quapaw Tribal Business Committee, Quapaw, Oklahoma	A letter was sent on 08-07-92, but no response has been received to the letter or to several attempts at phone communication.	
C.O. Tillman, Jr., Principal Chief	Osage Tribe of Indians, Pawhuska, Oklahoma	A letter was sent on 08-07-92, but no response has been received to the letter or to several attempts at phone communication.	



United States Department of the Interior

Fish and Wildlife Service
Fish and Wildlife Enhancement
Columbia Field Office
608 East Cherry Street
Columbia, Missouri 65201



In Reply Refer to:

JUN 12 1990

FWS/AFWE-CMFO

Paul M. Kroupa
Environmental Analyst
SRI International
333 Ravenswood Ave.
Menlo Park, California 94025

Dear Mr. Kroupa:

This responds to your letter, dated May 15, 1990, requesting the comments of the U.S. Fish and Wildlife Service (Service) on the proposed candidate sites for the Ground Wave Emergency Network (GWEN) relay node in southeastern Missouri, located near Dexter, in Stoddard County, Missouri.

These comments are provided as technical assistance and predevelopment consultation and do not constitute a Service report under authority of the Fish and Wildlife Coordination Act (Coordination Act) (16 U.S.C. 661 et seq.) on any required Federal environmental review or permit or license application.

The Service has responsibility, under a number of authorities, for conservation and management of fish and wildlife resources. Chief among the Federal statutes with which our office deals are the Coordination Act, Endangered Species Act, and the National Environmental Policy Act. The Coordination Act requires that fish and wildlife resources be given equal consideration in the planning, implementation, and operation of Federal and federally funded, permitted, or licensed water resource developments. Section 7 of the Endangered Species Act outlines procedures for interagency consultations on the effects of Federal actions on federally listed threatened and endangered species. The Service participates in scoping and review of actions significantly affecting the quality of the environment under authority of the National Environmental Policy Act. In addition to these statutes, the Service has authority under several other legislative, regulatory, and executive mandates to promote conservation of fish and wildlife resources for the benefit of the public.

In Missouri, the Service has special concerns for migratory birds (in particular waterfowl), endangered and threatened species, and other important fish and wildlife resources. We also are concerned about impacts to Federal and State wildlife refuges and management areas and other public lands, as

well as to other areas that support sensitive habitats. Habitats frequently associated with important fish and wildlife resources are wetlands, streams, and riparian (streamside) woodlands. Special attention is given to proposed developments that include modification of wetlands, stream alteration, or contamination of important habitats. The Service recommends ways to avoid, minimize, rectify, reduce, or compensate for damaging impacts to important fish and wildlife resources and habitats that may be attributed to land and water resource development proposals.

We have reviewed the proposed plans for the GWEN relay node in northeastern Missouri and offer the following comments:

1. The proposed project does not appear to impact Federal fish and wildlife management facilities.
2. Construction and operational activities should avoid wetlands and riparian zones to the maximum extent possible. If impact to these areas is unavoidable, a permit may be required from the U.S. Army Corps of Engineers and/or the Missouri Department of Natural Resources. If a Federal permit is required, the Service would review the application and provide recommendations.
3. Radio wave transmission towers of the type described in the project plans may pose the threat of entanglement or collision to large birds of prey or other migratory birds which traverse the area. We recommend that you ensure that all structural elements are visible to these species, especially during periods of low light intensity. This may require incorporation of marker devices into the design and construction of the guy wires, top loading elements, and other similar components in such a way as to make them more conspicuous to birds in flight. Reflectors, lights, aviation marker balls, colored spiral vibration dampers, or others devices would help increase the visibility of the numerous wires and other structural components of the tower and appurtenant facilities. Birds migrate in large groups during the fall and spring and many are killed or seriously injured when they fly into poorly marked above ground structures.

In addition, any above ground power lines associated with the project should be designed and constructed in a manner that minimizes threats of electrocution hazards to large birds of prey which use the poles, crossarms, and wires as perching sites. We recommend that you incorporate guidelines into the design and construction of such facilities similar to those found in the Raptor Research Foundation publication, "Suggested Practices for Raptor Protection on Power Lines: the State of the Art in 1981". Application of these guidelines to any above ground line segments should help ensure that this project would not adversely affect resident or migratory birds of prey.

4. In accordance with Section 7(c) of the Endangered Species Act, we have determined that the following federally-listed species may occur in the project area. No designated critical habitat occurs in the project area.

Paul M. Kroupa

3.

<u>Listed Species</u>	<u>Status¹</u>	<u>Expected Occurrence</u>
Bald eagle (<u>Haliaeetus leucocephalus</u>)	E	Migration, winter resident

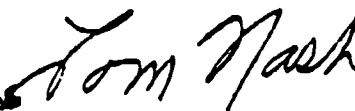
The nature of the subject project indicates that habitat for the species listed above likely would not be adversely affected, provided that measures assuring visibility of structural elements and elimination of electrocution hazards are incorporated into design and construction, as appropriate. If, however, the Department of the Air Force determines that the project may affect listed species, formal or informal consultation should be requested with this office. Likewise, should plans for this proposed project be modified, or new information indicate that listed species may be affected, consultation should be reinitiated with this office.

5. Please contact the Missouri Department of Conservation, (P.O. Box 180, Jefferson City, Missouri 65101) concerning State-listed endangered and threatened species.

Based upon the submitted information, we have no objection to this proposal as currently planned, provided that our recommendations are followed. However, should the plans be modified, we recommend that you reinitiate coordination with this office.

Should you have questions concerning these comments and recommendations, or if we can be of any further assistance, please contact Richard Szlemp at the address above, or by telephone at (314)876-1911 or (FTS)276-1911.

Sincerely,

Noting 
Jerry J. Brabander
Field Supervisor

cc: MDC; Jefferson City, MO (Attn: Dan Dickneits)
MDC; Jefferson City, MO (Attn: Dennis Figg)
MDNR; Jefferson City, MO (Attn: Charles Stiefermann)
EPA; Kansas City, KS (Attn: Kathy Mulder)

RRS:rs:1747SDGWENXA

¹E - federally-listed endangered, T - federally-listed threatened, P - proposed for Federal listing, CH - designated critical habitat



IN REPLY REFER TO

FWS/AFWE-CMFO

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Fish and Wildlife Enhancement
Columbia Field Office
608 East Cherry Street
Columbia, Missouri 65201



AUG 27 1991

Mr. Buford Holt, Senior Consultant
SRI International
333 Ravenswood Ave.
Menlo Park, California 94025

Dear Mr. Holt:

This responds to your letter of July 10, 1991, concerning the proposed Ground Wave Emergency Network (GWEN) relay facilities in the vicinities of Curreyville and Dudleyville, Missouri. Your letter indicated that the U.S. Air Force had agreed to place marker balls on the guy wires of these towers in accordance with U.S. Fish and Wildlife Service (Service) recommendations contained in our November 2, 1990, and May 28, 1991, letters. The Air Force also has agreed to use of a dual lighting system atop the towers to provide for additional visibility during low light conditions.

We also understand from your July 10, 1991, letter that the Air Force has not agreed to institute a monitoring program for the GWEN towers in Missouri. We had recommended a monitoring program in a June 19, 1991, letter to you based on discussions with our sister office in Pierre, South Dakota. Our reasoning for the addition of this recommendation was to lend consistency to the overall Service response to the GWEN projects; however, upon further consideration and discussion with our Pierre office, we have concluded that the nature of the Missouri GWEN sites is such that continued monitoring is not necessary, provided that the marking and lighting systems agreed to are installed and maintained through the life of the project.

Therefore, with implementation of the recommendations contained in our November 2, 1990, letter, and agreed to in your letter of July 10, 1991, the Service concurs that the proposed GWEN structures are not likely to adversely affect federally-listed threatened or endangered species. Keep in mind, however, that the withdrawal of our recommendation for a monitoring program for the Missouri sites in no way negates Service recommendations for such a program at other GWEN sites.

Again, we appreciate the assistance and cooperation that you and the Air Force have provided in this matter. Should you have questions or comments, or if we can assist you in the future, please contact this office at the address above or by telephone at 314/876-1911 or FTS 276-1911.

Sincerely,

Jerry J. Brabander
Field Supervisor

JOHN ASHCROFT
Governor

G. TRACY MEHAN III
Director



STATE OF MISSOURI
DEPARTMENT OF NATURAL RESOURCES

DIVISION OF PARKS, RECREATION, AND HISTORIC PRESERVATION

P.O. Box 176
Jefferson City, MO 65102
314-751-2479

Division of Energy
Division of Environmental Quality
Division of Geology and Land Survey
Division of Management Services
Division of Parks, Recreation,
and Historic Preservation

October 26, 1989

Mr. Buford Holt
Senior Consultant
SRI International
333 Ravenswood Ave.
Menlo Park, California 94025

RE: Proposed Ground Wave Emergency Network Project (DOD), Pike, Ralls,
Audrain, and Stoddard Counties, Missouri

Dear Mr. Holt:

In response to your letter dated 22 September 1989 concerning the above referenced project, our records indicate that the project area has never been professionally surveyed for archaeological, historical, or architectural resources. Since the National Historic Preservation Act (P.L. 89-665, as amended), the Advisory Council on Historic Preservation's regulation 36CFR Part 800, and Executive Order 11593 of 13 May 1971 require identification and evaluation of such cultural resources, it is recommended that such a survey be conducted prior to final formulization of project plans or any disruptive activities.

We would appreciate two (2) copies of the cultural resource survey when it is finished so we may complete the review and comment process.

If I can be of further assistance, please write or call 314/751-7860.

Sincerely,

HISTORIC PRESERVATION PROGRAM


Michael S. Weichman
Senior Archaeologist

MSW:nc

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JOHN ASHCROFT
Governor



J. TRACY MEHAN III
Director

Division of Energy
Division of Environmental Quality
Division of Geology and Land Survey
Division of Management Services
Division of Parks, Recreation,
and Historic Preservation

STATE OF MISSOURI
DEPARTMENT OF NATURAL RESOURCES

DIVISION OF PARKS, RECREATION, AND HISTORIC PRESERVATION

P.O. Box 176
Jefferson City, MO 65102
314-751-2479

March 27, 1990

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

RE: Proposed Ground Wave Emergency Network (GWEN) Project (DOD), Pike and
Stoddard Counties, Missouri

Dear Ms. Mendel:

We have been informed by Triad Research that field investigations for the cultural resources survey of the above referenced project have been completed. These field investigations resulted in the recordation of five (5) archaeological sites within the ten (10) selected project areas. Two (2) sites, 23PI224 and 23PI225, are located in Pike County project area 4C901MO/CGS-17. In Stoddard County, three (3) sites were recorded, one each in project areas 4C910MO/CGS-9 (23S0536), 4C910MO/CGS-6 (23S0537), and 4C910MO/CGS-11 (23S0538). It is our understanding that a report on these investigations will be forthcoming.

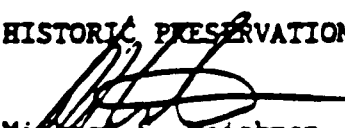
It is recommended that these archaeological sites be avoided or that further sub-surface investigations be undertaken to ascertain National Register of Historic Places eligibility and if eligible, the procedures in accordance with the Advisory Council on Historic Preservation's regulation Protection of Historic Properties (36 CFR Part 800) be initiated.

Pending completion of this process, you should refrain from taking or sanctioning any action or making any irreversible or irretrievable commitment that could result in an adverse effect on the National Register eligible properties or that would foreclose the consideration of modifications or alternatives to the proposed undertaking that could avoid, mitigate, or minimize such adverse effects.

If I can be of further assistance, please write or call 314/751-7958.

Sincerely,

HISTORIC PRESERVATION PROGRAM


Michael S. Weichman
Senior Archaeologist

MSW:nc

COPY AVAILABLE TO DTIC DOES NOT PERMIT FURTHER REPRODUCTION

cc: Gary Walters

JOHN ASHCROFT
Governor

G. TRACY MEHAN III
Director



STATE OF MISSOURI
DEPARTMENT OF NATURAL RESOURCES

DIVISION OF PARKS, RECREATION, AND HISTORIC PRESERVATION

Division of Energy
Division of Environmental Quality
Division of Geology and Land Sur
Division of Management Service
Division of Parks, Recreation,
and Historic Preservation

May 14, 1990

P.O. Box 176
Jefferson City, MO 65102
314-751-2479

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

RE: Proposed Ground Wave Emergency Network (GWEN) Project (DOD), Stoddard
County, Missouri

Dear Ms. Mendel:

The Historic Preservation Program has reviewed the 25 March 1990 final report entitled "A Phase I Survey and Evaluation of Four Proposed GWEN Project Areas, Stoddard County, Missouri" by Gary Walters. Based on this report, it is evident an adequate cultural resource survey has been made of the project area.

We agree with the investigator's recommendations as outlined on pages 27-29 of the report. If at all possible, the proposed GWEN project areas 4C910MO/CGS-9, 4C910MO/CGS-6, and 4C910MO/CGS-11 should be designed to avoid archaeological sites 23S0536, 23S0537, and 23S0538. If this is not feasible, the following course of action is strongly recommended. Subsurface archaeological testing of 23S0536, 23S0537, and 23S0538, sites potentially eligible for inclusion in the National Register, should be initiated with the results submitted to the Missouri Historic Preservation Program and the Department of Defense to ascertain eligibility for inclusion in the National Register of Historic Places in accordance with the procedures as set forth in Section 800.4(c) of the Advisory Council on Historic Preservation's regulation Protection of Historic Properties (36CFR Part 800).

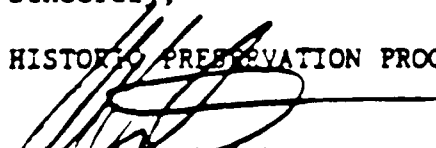
In the event these sites are determined eligible, then the appropriate course of action as outlined in Section 800.5 of the Advisory Council on Historic Preservation's regulations should be implemented.

Pending completion of this process, no action should be taken that would foreclose consideration of alternatives to avoid or satisfactorily mitigate any adverse effects on archaeological site 23S0536, 23S0537, and 23S0538.

If I can be of further assistance, please write or call 314/751-7958.

Sincerely,

HISTORIC PRESERVATION PROGRAM


Michael S. Weichman
Senior Archaeologist

MSW:nc

JOHN ASHCROFT
Governor

G. TRACY MEHAN III
Director



STATE OF MISSOURI

DEPARTMENT OF NATURAL RESOURCES

DIVISION OF PARKS, RECREATION, AND HISTORIC PRESERVATION

P.O. Box 176
Jefferson City, MO 65102
314-751-2479

Division of Energy
Division of Environmental Quality
Division of Geology and Land Survey
Division of Management Services
Division of Parks, Recreation
and Historic Preservation

September 9, 1991

Mr. Daniel Rutledge
Research Analyst
Environmental Assessment Program
SRI International
333 Ravenswood Ave.
Menlo Park, California 94025

RE: Proposed Ground Wave Emergency Network Project (DOD-USAF), Audrain, Pike,
Ralls, and Stoddard Counties, Missouri

Dear Mr. Rutledge:

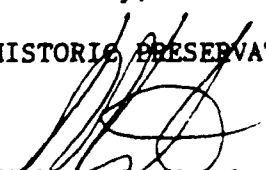
In response to your letter dated 21 August 1991 concerning the above referenced project, the Missouri Historic Preservation Program has reviewed the information provided and has determined there is a low probability that significant architectural resources are located within 1.5 miles of the proposed project areas. Therefore, an architectural survey is not warranted.

However, if the currently defined project area or scope of project related activities are changed or revised, the Missouri Historic Preservation Program must be notified and appropriate information relevant to such changes or revisions be provided for further review and comment, in order to ascertain the need for additional investigations.

If I can be of further assistance, please write or call 314/751-7860.

Sincerely,

HISTORIC PRESERVATION PROGRAM


Michael S. Weichman
Senior Archaeologist

MSW:mc

RECEIVED
JUN 12 1990

United States Department
of the interior
Fish and Wildlife Service
Fish and Wildlife Enhancement
Columbia Field Office
Attn: Mr Jerry J. Brabander
608 East Cherry Street
Columbia, MO 65201

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

This is to verify that no changes have been made to the list of
federally-designated threatened, endangered, or candidate species
sent on June 12, 1990.


Jerry J. Brabander

5-14-92
Date

Changes have been made to the list of federally-designated threat-
ened, endangered, or candidate species since our correspondence
to you on June 12, 1990. Enclosed is a new list of species.

Jerry J. Brabander

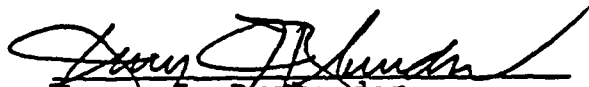
Date

RECEIVED
NOV 8 1993

United States Department
of the interior
Fish and Wildlife Service
Fish and Wildlife Enhancement
Columbia Field Office
Attn: Mr Jerry J. Brabander
608 East Cherry Street
Columbia, MO 65201

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

This is to verify that no changes have been made to the list of
federally-designated threatened, endangered, or candidate species
sent on May 14, 1992.


Jerry J. Brabander

12-22-92
Date

Changes have been made to the list of federally-designated
threatened, endangered, or candidate species since our
correspondence to you on May 14, 1992. Enclosed is a new list of
species.

Jerry J. Brabander

Date



the
**Chickasaw
Nation**

OFFICE OF THE GOVERNOR

Arlington at Mississippi / Box 1548 / Ada, OK 74820 / (405) 436-2603

Bill Anoatubby
Governor

August 21, 1992

Ms. Holly Mendel
SRI International, Room AG 349
333 Ravenswood
Menlo Park, CA 94025

Dear Ms. Mendel:

Thank you for the packet of information regarding the U.S. Air Force's Ground Wave Emergency Network project in southern Missouri. We appreciate your company's consideration of the Chickasaw Nation in this matter as it relates to the American Indian Religious Freedom Act and the National Historic Preservation Act. Since there are no known sites of historical or cultural importance to the Chickasaw Nation in that area, we have no connected concerns of our own.

Again, thank you for writing.

Sincerely,

Bill Anoatubby
Bill Anoatubby, Governor
The Chickasaw Nation

APPENDIX D

GLOSSARY

GLOSSARY

Abbreviations and Units of Measure

AM	Amplitude Modulation
ATU	Antenna tuning unit
BIA	Bureau of Indian Affairs
BUPG	Back-up power group
CFR	Code of Federal Regulations
CGS	Candidate GWEN site
CRP	Conservation Reserve Program; a 10-year program whereby farmland is not cultivated to prevent erosion
CSR	Code of State 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
FIA	Federal Insurance Agency
FICWD	Federal Interagency Committee for Wetland Delineation
FOC	Final Operational Capability, the third phase of development of GWEN
GPO	Government Printing Office
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
MDC	Missouri Department of Conservation
mg/l	Milligrams per liter
MHDT	Missouri Highway and Transportation Department

MM	Modified Mercalli, a scale of the severity of earthquake effects
µg/l	Micrograms per liter
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
PAWS	Potential areawide sites; the portion(s) of an SSA left after 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
PGSR	Preferred GWEN Site Report
PSER	Preliminary Site Evaluation Report
SCCO	Stoddard County Commissioner's Office
SCS	Soil Conservation Service

SHPO	State Historical 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
TLCC	Thin Line Connectivity Capability; the second phase of development of GWEN
TRS	Triad Research Services
UHF	Ultrahigh frequency (band); specifically 300 to 3,000 megahertz
USAF	United States Air Force
USC	United States Code
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
VMC	Visual Modification Class

Definitions

Air pollutant	An atmospheric contaminant, particularly the 15 atmospheric contaminants specified in federal and most state regulations
Alluvium	Material, such as sand, silt, or clay, deposited on land by streams; soils with an alluvium base are susceptible to shifting or liquefaction during earthquakes
Anaerobic	Occurring in the absence of free oxygen
Candela	A unit of measure of the intensity of light equal to the brightness of one candle
Cultural resource	Prehistoric, Native American, and historic sites, districts, buildings, structures, objects, and any other physical evidence of past human activity
Devonian period	Geological period of time during the Paleozoic era, 350 million to 400 million years ago
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 <i>Federal Manual for Identifying and Delineating Jurisdictional Wetlands</i> (GPO 1989-236-985/00336), a wetland is a class of habitats distinguished by the presence of saturation to the surface of 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)
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 aboveground structures and resources that are listed or eligible for listing on National Register of Historic Places
Hydric soil	A soil that is saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions in the upper part
Mississippian period	Geological period of time 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 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 tidal waves and landslides; MM intensity XII would cause nearly total destruction to 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
Palustrine wetlands	All nontidal wetlands dominated by trees, shrubs, persistent emergent vegetation, emergent mosses or lichens, and all such wetlands that occur in tidal areas where salinity due to ocean-derived salts is below 5 percent
Perched water table	Unconfined water separated from the underlying main body of water by unsaturated rock
pH	A measure of acidity in which the lower the number, the more acid the substance; 7 represents neutrality
Phase I ar- chaeological survey	A survey conducted by a trained archaeologist that is designed to test for the presence or absence of archaeological resources; it involves walking an area at predetermined intervals and may involve digging small shovel pits if ground visibility is low

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
Top-loading element	Portions of the antenna that extend diagonally from the top of the tower, which strengthen the signal and provide additional structural support, like guy wires