DOVER AIR FORCE BASE
DIGITAL AIRPORT SURVEILLANCE RADAR
ENVIRONMENTAL ASSESSMENT

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EXECUTIVE SUMMARY

This environmental assessment (EA) has been completed as part of the National Environmental Policy Act (NEPA) process, in compliance with USAF instruction AFI 32-7061. According to this instruction, the environmental assessment is a written analysis which serves to provide analysis sufficient to determine whether to prepare an Environmental Impact Statement (EIS) or a Finding of No Significant Impact (FONSI) and to aid federal agencies in complying with NEPA when no EIS is required.

This EA describes the proposed project to install a Digital Airport Surveillance Radar (DASR) at Dover Air Force Base (AFB) in Delaware. This proposed action is part of the DoD National Airspace System (NAS) Program, which involves installation of new air traffic control equipment on U.S. Army, U.S. Navy, and USAF bases throughout the country. DoD NAS is a component of the aviation system capital investment plan developed by the Federal Aviation Administration (FAA) to modernize approach control systems in the United States and its territories.

The NAS program will comprehensively upgrade air traffic control systems infrastructure by systematically replacing analog systems with state-of-the-art digital technology. The purpose of the DASR component of the USAF NAS program is to detect and process aircraft position and weather conditions at USAF airfields. The DASR system will use the ASR-11 radar to accurately locate aircraft, in terms of range, azimuth, and altitude; provide information regarding aircraft identification code; identify emergency conditions; and report six discreet weather precipitation levels. The ASR-11 at Dover AFB is needed to replace the older existing Airport Surveillance Radar (AN/GPN-20), installed in April 1983.

The DASR facilities at Dover AFB would consist of: primary and secondary radar electronics, rotating antenna, 67- or 87-foot tower (depending on location), utility cabling, an uninterrupted power supply, an emergency generator, power conditioning, electronic equipment grounding systems, and a fuel storage system (1,000 gallon aboveground storage tank). Facility construction, including separate concrete foundations for the ASR-11 antenna tower, equipment shelter, and engine generator shelter; fencing; and security system would be within a 0.45 acre site (140 feet by 140 feet). Additional miscellaneous site improvements may include minor re-grading, installation of geotextile fabric beneath six inches of crushed stone, and an unpaved access road. Once the new DASR system is operational, the existing AN/GPN-20 will be dismantled and structures razed. The ground would be reclaimed by Dover AFB.

Nine areas were initially identified and evaluated as potential ASR-11 sites. Five of these sites were eliminated primarily due to conflicts with existing or planned development, and a sixth site was eliminated due to existing arboreal vegetation and high water table. The three remaining alternative sites on Dover AFB have been identified as potential locations for the ASR-11, based on operational, construction, and environmental siting criteria contained in the *National Airspace System Digital Airport Surveillance Radar Siting Plan* and the Dover AFB Final Site Survey Report. The three remaining sites (2, 5, and 8) are evaluated in this EA.

Site 2 is located on the northern side of Dover AFB, approximately 4,300 feet north of the Air Traffic Control Tower, approximately 4,100 feet southwest of the end of Runway 01/19 in an area that is presently used as an obstacle course just off the base perimeter road. The existing obstacle course could be relocated adjacent to the ASR-11; however, the site=s potential future use for a portable radar and an Air National Guard training unit would be precluded by the ASR-11. Site 2 is also located 400 feet southeast of an off-

base, private residential neighborhood composed of approximately 30 single-family homes. Locating the ASR-11 at Site 2 would result in short-term disruption to this neighborhood, and would result in a change in visual aesthetics. According to 1990 census data, the income of 40 percent of the population within this census tract is below the federal poverty level, potentially raising the issue of environmental justice. While a low income population group does reside adjacent to alternative Site 2, no adverse human health and environmental impacts are anticipated to occur as a result of operation of the ASR-11. Therefore, the DASR program at Dover AFB is consistent with Executive Order #12898.

Site 5 is located 500 feet southwest of the existing AN/GPN-20 and north of Taxiway E. The site is a flat area of mowed grass within the airfield. Site 5 is located in close proximity to, and is visible from, Building 1301, a National Register of Historic Places site which houses the Air Museum. The existing radar is visible from the museum, therefore the replacement of the existing radar with the ASR-11 would not substantially change visual aesthetics in the vicinity of the museum.

Site 8 is located in an open area 275 feet southeast of a base playground and across the perimeter road from a base family campground. Site 8, itself, is partly within LF-17, an area previously used during the 1960s as a trench and fill landfill; after disposal activities ceased, the site was covered with several feet of soil and is currently maintained as a mowed grassy field. An ROTC training area and skeet and trap range are located approximately 1,600 feet to the south. Baseball fields are located to the southwest and northeast, approximately 500 feet and 600 feet, respectively, from Site 8. Concern was raised regarding the potential for long-term aesthetic impacts of the proposed radar tower on three historic sites: the Dickinson Mansion, the John Wesley Cemetery, and the St. Jones Neck Homestead/Farm. An evaluation, including field test and photo simulation, was conducted to assess the potential visual impact of the proposed ASR-11. Results of the evaluation indicate that the radar is either not visible, or merges with the existing landscape in views from the plantation and homestead both of which are located off-base property. The radar is visible from the southwest corner of the cemetery but the view is consistent with other views of base facility. The cemetery, which is not listed on the National Register, is located on base property. Therefore, no adverse impacts to cultural resources are anticipated.

Issues that must be addressed during construction at any of the sites are elevated noise levels, increased dust, traffic and access disruption, aesthetic effects, site stability, and groundwater and storm water management issues. Potential impacts in these areas can be reduced using standard mitigation measures as outlined below:

- During the construction period, sheeting or supports of some kind may be used in the areas excavated for the tower footings and utility trenches in order to prevent collapse of these excavated areas.
- Groundwater levels will be monitored and maintained as necessary.
- To minimize noise impacts during construction, mufflers would be used on construction equipment and vehicles.
- All equipment and vehicles used during construction would be maintained in good operating condition so that emissions are minimized, thus reducing the potential for air quality impacts.
- Dust will be controlled onsite by using water to wet down disturbed areas.
- All areas disturbed for the ASR-11 construction would be seeded with a grass mixture or covered with a geotextile fabric and crushed stone to stabilize the disturbed soils, in order to minimize the potential for erosion and sedimentation.

- All hazardous materials used during construction would be handled and disposed of in accordance with Dover AFB policies and protocols and all applicable state and federal regulations.
- Traffic management measures will be developed to facilitate traffic flow and pedestrian access.

Potential future impacts associated with operation of the ASR-11 facility would be minimized through the use of mitigation measures including the following:

- All hazardous materials used during operation would be used and disposed of in accordance with Dover AFB policies and protocols and all applicable state and federal regulations.
- Due to the potential for electromagnetic radiation hazards during operation, warning signs, indicating the safe distance from the operating radar, will be installed at the facility perimeter.

Each of the three alternative DASR sites would be acceptable from an environmental perspective. However, impacts associated with land use and aesthetic resources would be anticipated at Sites 2 and 8; and impacts associated with historic resources would be anticipated at Site 5. Table ES-1 provides a summary of the potential environmental impacts associated with each of the alternative sites. The Air Force has selected Site 8 as the preferred ASR-11 location; however, this EA identifies potential impacts associated with placing the ASR-11 at each of the alternative sites.

Table ES-1. Environmental Impact Summary Matrix for the Alternative ASR-11 Sites at Dover AFB

Category	No Action Alternative	Existing AN/GPN-20 Removal	Site 2	Site 5	Site 8
Land Use	No Impact	Land currently occupied by the AN/GPN-20 could be reclaimed by Dover AFB.	Temporary relocation of the obstacle course; possible dust/noise/visual impacts to residential area; may preclude site's potential future use for a portable radar and Air National Guard training unit	Possible dust/noise/visual impacts to Air Museum; construction vehicles would have to cross Taxiway E	Possible dust/noise/visual impacts to nearby recreational areas
Socioeconomics	No Impact	Installation of ASR-11 and dismantling of AN/GPN-20 both expected to have short-term minor contributions to the local economy; no long-term impacts are expected.			
Utilities and Transportation	No Impact	No Impact	Connections to existing utilities would require the following trenching distances: Electricity: 950 ft, Telephone: 950 ft, Fiber Optic: 950 ft	Connections to existing utilities would require the following trenching distances: Electricity: 100 ft, Telephone: 200 ft, Fiber Optic: 200 ft	Connections to existing utilities would require the following trenching distances: Electricity: 900 ft, Telephone: 170 ft, Fiber Optic: 170 ft
Noise	No Impact	Installation of ASR-11 and dismantling of AN/GPN-20 both expected to result in short-term noise impacts due to construction activities. Operation of the ASR-11 system would not generate excessive or persistent levels of noise, therefore no long-term impacts are anticipated.			
Air Quality		Short term impacts from removal of existing AN/GPN-20 and installation of ASR-11 expected to consist of dust generation from construction activities and anticipated to be minimal. Long term impacts associated with all alternatives consist of evaporative loss from aboveground storage tank and emissions from on-site emergency generator; however, neither sources are anticipated to represent a substantial impact to air quality.			
Geology and Soils	No Impact	No Impact	Poor soil conditions may require deeper excavation for foundation support as well as possible construction of a paved (as opposed to gravel) access road	No Impact	Poor soil conditions may require deeper excavation for foundation support.
Surface Water and Groundwater	No Impact	No Impact	Construction may encounter seasonally high groundwater table.	No Impact	No groundwater is anticipated to be encountered, however, previous contamination at site may require monitoring and treatment if groundwater encountered during construction
Biological Resources	No Impact	No Impact	All sites consist of mown grass and do not contain wetlands or unique habitat for wildlife. Other than the clearing of grassy vegetation, no impacts are anticipated to biological resources		
Aesthetic Resources	No Impact	No Net Change	Potential visual impact to off-base residential neighborhood, although partially mitigated by existing trees/shrubs	Radar would be visible from the Air Museum, approximately 800 feet distant	Radar would be adjacent to playground, recreational fields, and family camping area; radar would be visible from west side of John Wesley Cemetery, less visible from John Dickinson Plantation and St. Jones Neck Homestead/Farm.
Cultural Resources	No Impact	No Impact	No Impact	Radar would be visible from the Air Museum, approximately 800 feet distant	Radar would be visible from west side of John Wesley Cemetery, less visible from John Dickinson Plantation and St. Jones Neck Homestead/Farm. Views would be consistent with existing views of military facilities and activities. No adverse impacts anticipated.
Pollution Prevention and Hazardous Waste	Hazardous materials used during operation of facility will continue being handled in compliance with all applicable regulations and base policies, therefore no impacts are expected.	No Impact	Hazardous materials used during operation of facility will be handled in compliance with all applicable regulations and base policies, therefore no impacts are expected.	Hazardous materials used during operation of facility will be handled in compliance with all applicable regulations and base policies, therefore no impacts are expected.	Construction may encounter buried refuse such as pipes, steel sign posts, wire cable associated with former LF-17. Hazardous materials used during operation of facility will be handled in compliance with all applicable regulations and base policies, therefore no impacts are expected.
Electromagnetic Energy	No impact expected - due to the potential for RFR hazards during operation, warning signs, indicating the safe distance from the existing radar, are installed at the facility perimeter	No Net Change	No impacts expected. Due to the potential for RFR hazards during operation, warning signs, indicating the safe distance from the operating radar, would be installed at the facility perimeter.		

1.0 PURPOSE AND NEED FOR ACTION

1.1 INTRODUCTION

The National Environmental Policy Act (NEPA; 42 U.S.C. Sections 4321-4347) is the basic national charter for protection of the environment (CEQ, 1978). NEPA establishes policy, sets goals, and provides the process for carrying out the policy and achieving the goals. NEPA procedures were established to ensure that environmental information is available to public officials and citizens before decisions are made and before actions are taken. To implement NEPA, the U.S. Air Force (USAF) has issued an internal instruction AFI 32-7061 (USAF, 1995a) that contains policies, responsibilities, and procedures dictating how NEPA should be implemented for USAF projects.

This environmental assessment (EA) has been prepared in compliance with AFI 32-7061. According to this instruction, the environmental assessment is a written analysis which serves to (1) provide analysis sufficient to determine whether to prepare an Environmental Impact Statement (EIS) or a Finding of No Significant Impact (FONSI); and (2) aid federal agencies in complying with NEPA when no EIS is required. If this EA were to determine that the proposed project would significantly degrade the environment, significantly threaten public health or safety, or generate significant public controversy, then an EIS would be completed. An EIS involves a comprehensive assessment of project impacts and alternatives and a high degree of public input. Alternatively, if this EA results in a FONSI, then the action would not be the subject of an EIS. The EA is not intended to be a scientific document. The level and extent of detail and analysis in the EA is commensurate with the importance of the environmental issues involved and with the information needs of both the decision makers and the general public.

The proposed action addressed in this EA is the construction of a Digital Airport Surveillance Radar (DASR) at Dover Air Force Base (AFB) in Delaware. This proposed action is part of the DoD National Airspace System (NAS) Program, which involves installation of new air traffic control equipment on U.S. Army, U.S. Navy, and USAF bases throughout the country. These radars are also being installed at commercial airports under the authority of the Federal Aviation Administration (FAA). The implementation of the NAS program at DoD bases was previously evaluated in a programmatic EA and FONSI (USAF, 1995b), which fully detail the need for the program. The programmatic EA and FONSI are available on the internet at

http://www.hanscom.af.mil/ESC-BP/pollprev/products.htm. Environmental review at FAA airfields is being conducted separately.

The programmatic EA for the NAS program is committed to completing site-specific NEPA documentation tiered to the programmatic EA for individual NAS sites. This EA addresses the site-specific impacts of locating an ASR-11 on Dover AFB, and evaluates the consequences of the ASR-11 construction and operation on the environment.

1.2 PURPOSE OF THE ACTION

The NAS program was developed to modernize military approach control systems in the United States and its territories. DoD NAS is a component of the aviation system capital investment plan developed by the Federal Aviation Administration (FAA). Pursuant to the Program Management Directive (USAF, 1994), the DoD must provide services within its delegated airspace which are comparable to the services which FAA provides to civil aircraft in civilian airspace. These services include: flight following, separation, expeditious handling, radar approach control, and landing.

The purpose of the DASR component of the USAF NAS program is to detect and process aircraft position and weather conditions at USAF airfields. The DASR will serve to accurately locate aircraft, in terms of range, azimuth, and altitude; provide information regarding aircraft identification code; identify emergency conditions; and report six discreet weather precipitation levels. The new radar facility will not increase or decrease the current number of flights, change aircraft patterns, or otherwise alter existing base operations.

1.3 NEED FOR THE ACTION

The USAF NAS program will comprehensively upgrade air traffic control systems infrastructure by systematically replacing analog systems with state-of-the-art, digital technology. The ASR-11 at Dover AFB is needed to replace the older, existing Airport Surveillance Radar (AN/GPN-20), which was installed in April 1983. The proposed new DASR system will take advantage of the significantly increased capabilities of digital technology now available in radars. A 1992 DoD study (USAF, 1992) concluded that retention of the present NAS equipment would cost more over its life cycle than would replacement with modern systems.

2.0 DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

The proposed action is the installation of a DASR system at Dover AFB (Figure 2-1) to replace the existing AN/GPN-20 radar facility. Alternatives to the proposed action include no action, or installation of the ASR-11 at an alternative site. The no-action alternative consists of **not** constructing the ASR-11 facility and would involve the continued use of the existing AN/GPN-20 system. Three alternative sites (Figure 2-2) for the ASR-11 on Dover AFB have been identified, in accordance with the NAS Siting Plan (USAF, 1995b). This EA discusses and evaluates potential impacts associated with the placement of the ASR-11 at each of the three alternative sites and also summarizes the potential impacts associated with the no-action alternative.

2.1 PROPOSED ACTION: DASR SYSTEM AT DOVER AFB

2.1.1 DASR System

The DASR system would detect and process aircraft position and weather conditions at the airfield. The DASR system would consist of two subsystems: the primary radar and the integrated secondary surveillance radar. The purpose of the subsystems would be to accurately locate aircraft, in terms of range, azimuth, and altitude.

The primary radar would transmit electromagnetic waves in the form of radio frequency pulses which backscatter from the surface of aircraft. The radar would measure the time required for an echo to return and the direction of the signal in order to determine the aircraft range and azimuth, respectively. By comparing variations in returned signal parameters, such as phase differences between pulses, the radar could separate moving targets from stationary clutter, such as mountains and trees. The primary radar would also report six discrete weather precipitation levels (from mild to hazardous) via a processing channel dedicated to weather detection and reporting.

The secondary surveillance radar (also called the beacon radar) would be a cooperative system consisting of ground-based beacon interrogator/receiver systems and existing aircraft based transponders. The secondary radar would obtain additional information, such as identification code,

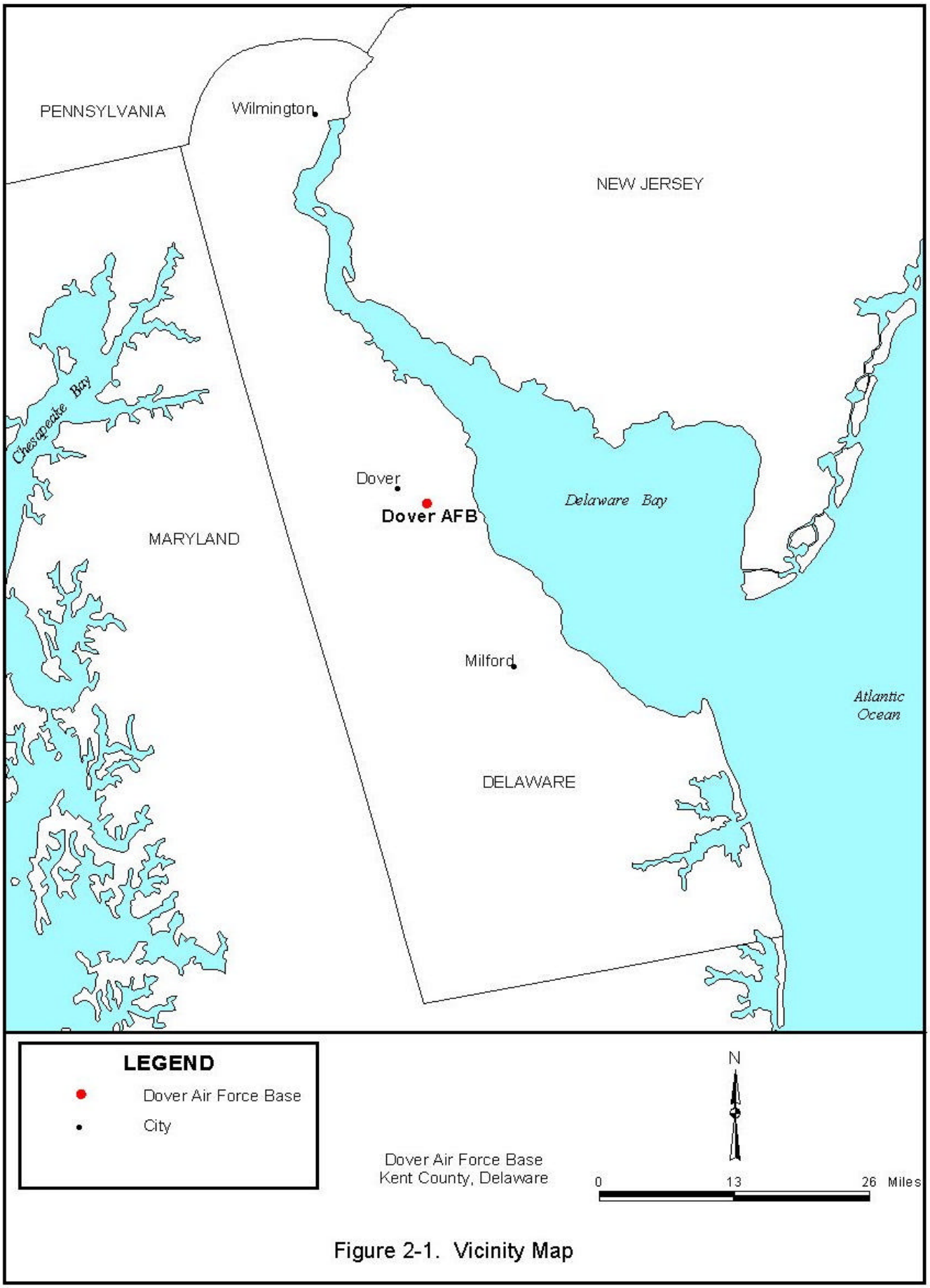
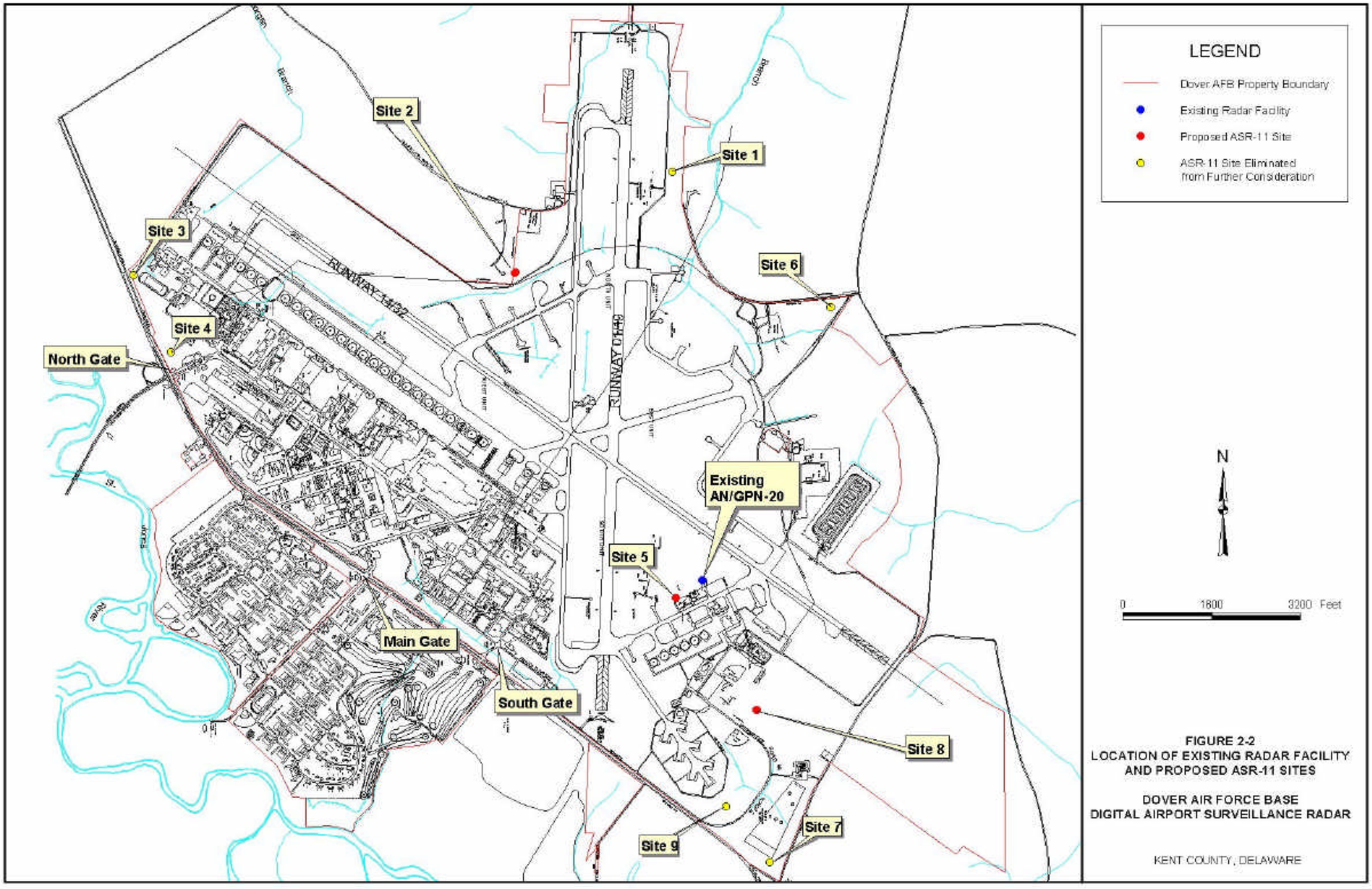


Figure 2-1. Vicinity Map


LEGEND
Dover AFB Property Boundary
Existing Radar Facility
Proposed ASR-11 Site
ASR-11 Site Eliminated from Further Consideration
N
0
1600
3200 Feet
Site 1
Site 2
Site 3
Site 4
Site 5
Site 6
Site 7
Site 8
Site 9
North Gate
Main Gate
South Gate
Existing AN/GPN-20
RUNWAY 14/32
RUNWAY 01/19
FIGURE 2-2
LOCATION OF EXISTING RADAR FACILITY AND PROPOSED ASR-11 SITES
DOVER AIR FORCE BASE
DIGITAL AIRPORT SURVEILLANCE RADAR
KENT COUNTY, DELAWARE

barometric altitude, and emergency conditions, from an aircraft transponder. Various processing techniques would be used to decipher both overlapping responses from multiple aircraft (synchronous garble) and aircraft responses to other beacon systems (asynchronous interference). The beacon radar would also provide rapid identification of aircraft in distress.

The DASR system would provide highly accurate target data to the Dover AFB Local Control Facilities (LCF) and Military Control Towers (MCT). The DASR system would have clutter rejection, target accuracy, and probability of detection that are equal to or better than the existing AN/GPN-20.

The DASR facilities at Dover AFB would consist of: primary and secondary radar electronics, rotating antenna, 67-foot (Site 5) or 87-foot (Sites 2 and 8) tower, interconnecting utility cabling, an uninterruptable power supply, an emergency generator, power conditioning, electronic equipment grounding systems, and a fuel storage system (1,000 gallon aboveground storage tank) (See Figure 2.3). Facility construction, including separate concrete foundations for the ASR-11 antenna tower, equipment shelter, and engine generator shelter, fencing, and security system would primarily be within a 0.45 acre site (140 feet by 140 feet) (USAF, 1999a). Additional miscellaneous site improvements may include minor re-grading, installation of geotextile fabric beneath six inches of crushed stone, and an unpaved access road. Site 2 may need a paved access road due to poor soil conditions at this location.

Figure 2-3 Typical ASR-11 Facility

Depending on the site chosen, approximately 100 to 950 feet of utility trenching between the edge of the site and existing duct banks/manholes would be required to connect the ASR-11 to existing telephone and electric lines (USAF, 1999a). In addition, between 6,100 and 10,000 feet of new fiber optic cable, depending on the site chosen, would be required (although much of this length could be installed within an existing duct bank) to connect the ASR-11 to the Radar Approach Control (RAPCON), which Dover AFB anticipates will be completed as part of the new Base Operations Complex (under a separate project) by early 2001 (USAF, 1999a). No new roads would be constructed with the exception of a short driveway to access the radar tower. Once the new DASR system is operational, the existing AN/GPN-20 would be dismantled and structures would be razed. The ground would be reclaimed by Dover AFB.

2.1.2 Alternative ASR-11 Sites

Three alternative sites on Dover AFB have been identified as potential locations for the ASR-11, based on the siting criteria contained in the *National Airspace System Digital Airport Surveillance Radar Siting Plan* (USAF, 1995b). The three sites evaluated in this EA were identified based on operational, construction, and environmental criteria. The operational criteria included the following (DOT FAA, 1992):

- The site should not be located closer than 0.5 mile from the end of any existing or planned runway.
- The site should not be located closer than 0.5 mile from any point of required detection coverage.
- The site should not be located closer than 2,500 feet from any existing or planned electronic equipment installation or facility.
- The site should not be located less than 0.5 mile from National Weather Bureau radars and radiosonde equipment.
- The site should not be located closer than 1,500 feet to any above-ground object which would interfere or cause degradation in the ASR-11 operation.

The operational characteristics of the new ASR-11 as compared to the existing AN/GPN-20 are shown in Table 2.1-1.

Table 2.1-1. Comparison of Characteristics of Existing AN/GPN-20 and Proposed ASR-11

	AN/GPN-20[(a)]	**ASR-11**
Frequency	2730-2802 MHz / 1030 MHz	2700-2900 MHz 2 frequencies separated by at least 30 MHz
Power Peak	0.8 microsec (56 dBM)	19.5 kilowatts (I microsec) 18.0 kilowatts (89 microsec)
Average Power	0.8 microsec (56 dBM)	1600 Watts (solid state)
Pulse Repetition Frequency	1013 pulse/second	720-1050 pulse/second

(a) Source: Dover AFB Radar Maintenance; MITRE, 1997

Construction criteria included siting the ASR-11 in an area with a slope of less than 20 percent and away from occupied existing structures, railroads, highways, runways and taxiways, or power lines. The environmental criteria for siting included avoiding a number of sensitive resources, including: ecological/wildlife refuges, preserves, conservation areas and sanctuaries; wild and scenic rivers; prime and unique farmlands; historical, archaeological, and cultural sensitive sites; wetlands and floodplains; threatened and endangered species habitat; and designated hazardous waste sites. The details of the siting process are described in the Final Site Survey Report (USAF, 1999a)(See Appendix B).

Initial site selection screening criteria identified nine sites (Sites 1 through 9, Figure 2-2) for consideration at the in-briefing, held October 20, 1998. Of the nine initial sites, only four were considered to have reasonable developmental potential. **Site 1** and **Site 4** were eliminated because they were located too close to aircraft movement areas or planned land uses. **Site 3** was rejected due to the potential to impact an existing fitness field and aesthetic resources. **Site 7** was eliminated because there is planned redevelopment of the U.S. 113/Rte 9 intersection that would impact the site. **Site 9** was eliminated because it would prohibit future expansion of the aircraft parking apron. Of the four remaining sites, **Site 6** was eliminated after further analysis, due to its location in a forested area with a high water table.

Figures 2-4 through 2-6 illustrate planned layouts of the ASR-11 and supporting facilities at each of **Sites 2**, **5**, and **8**.

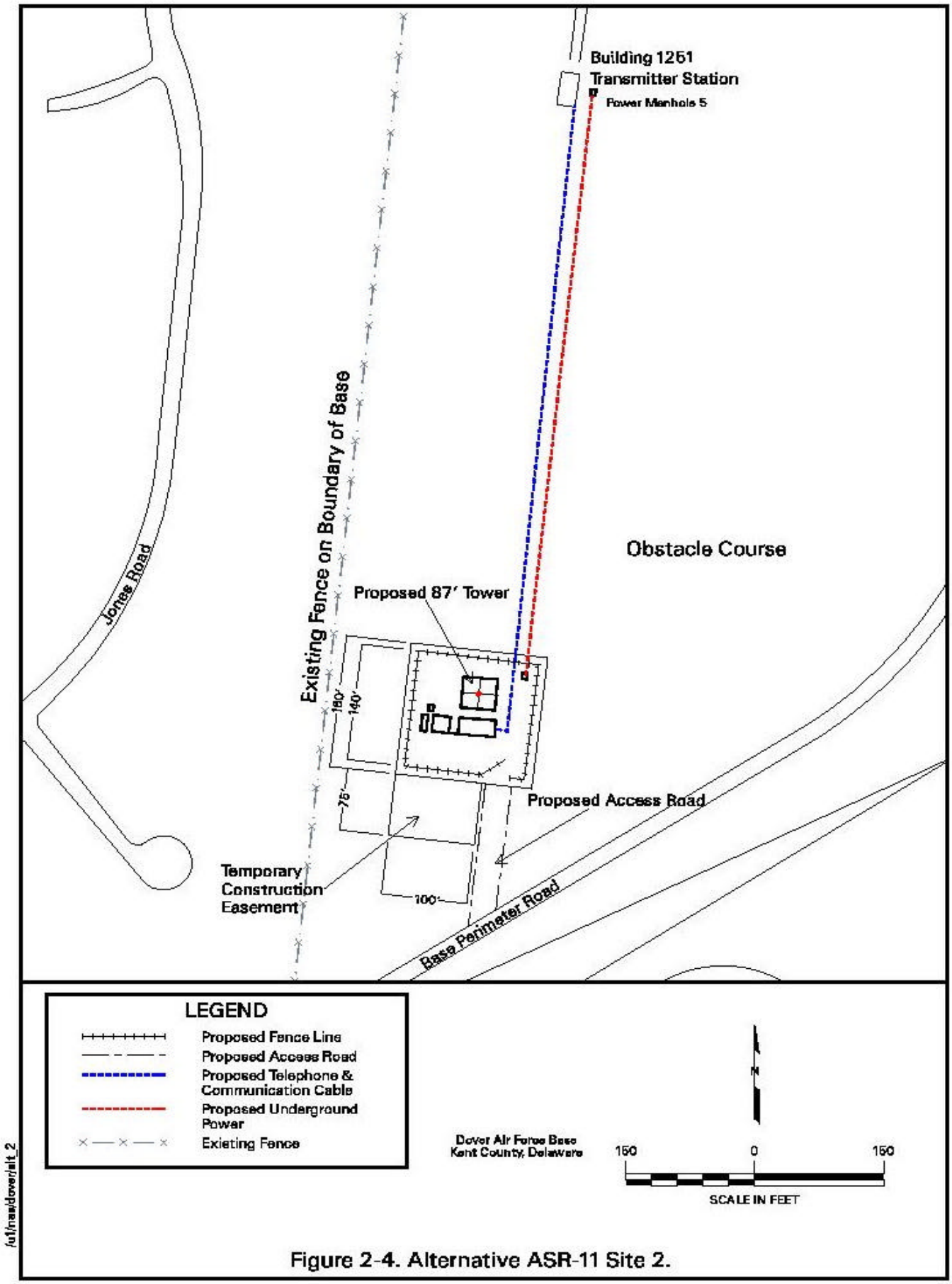


Figure 2-4. Alternative ASR-11 Site 2.

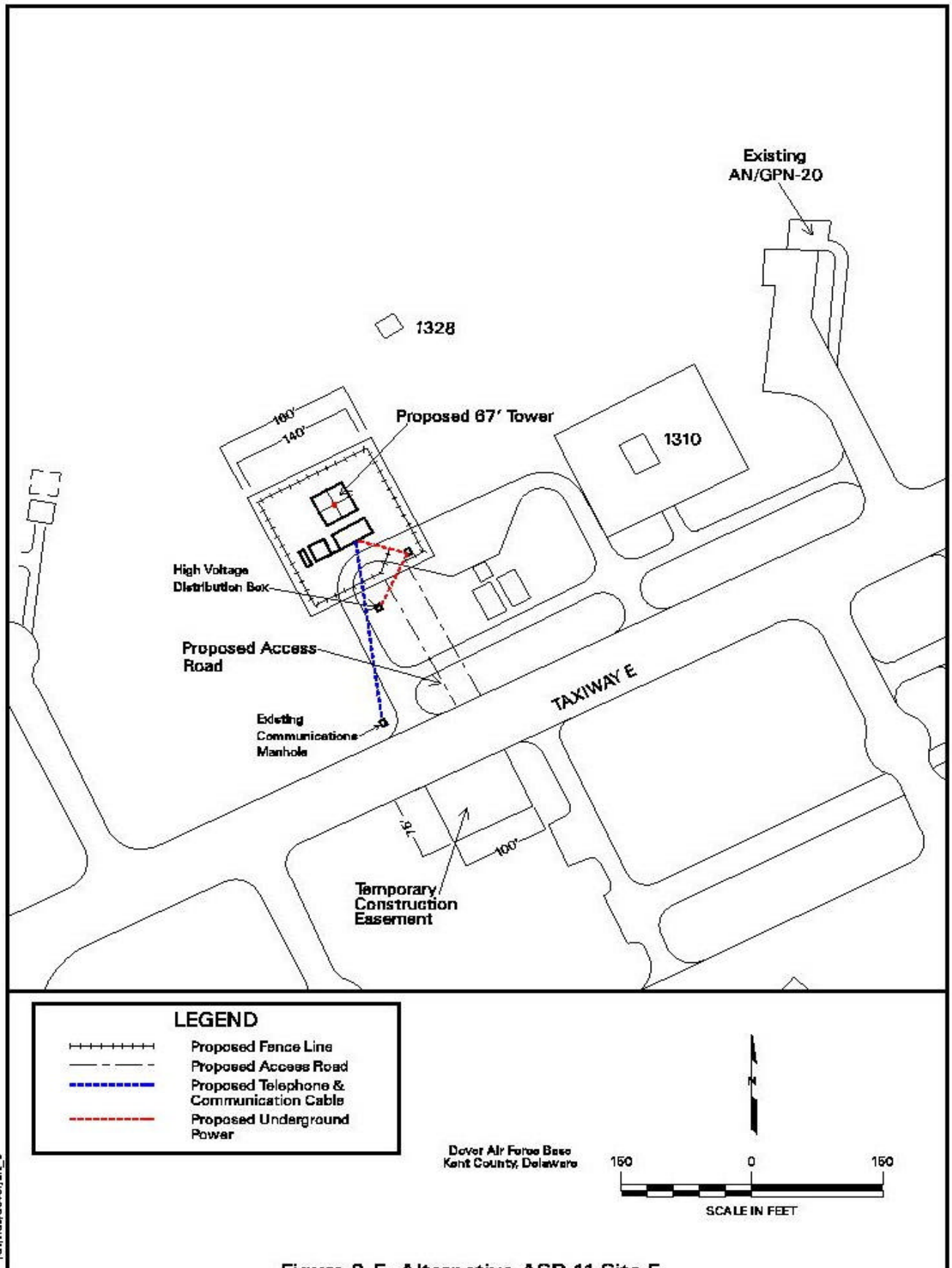


Figure 2-5. Alternative ASR-11 Site 5.

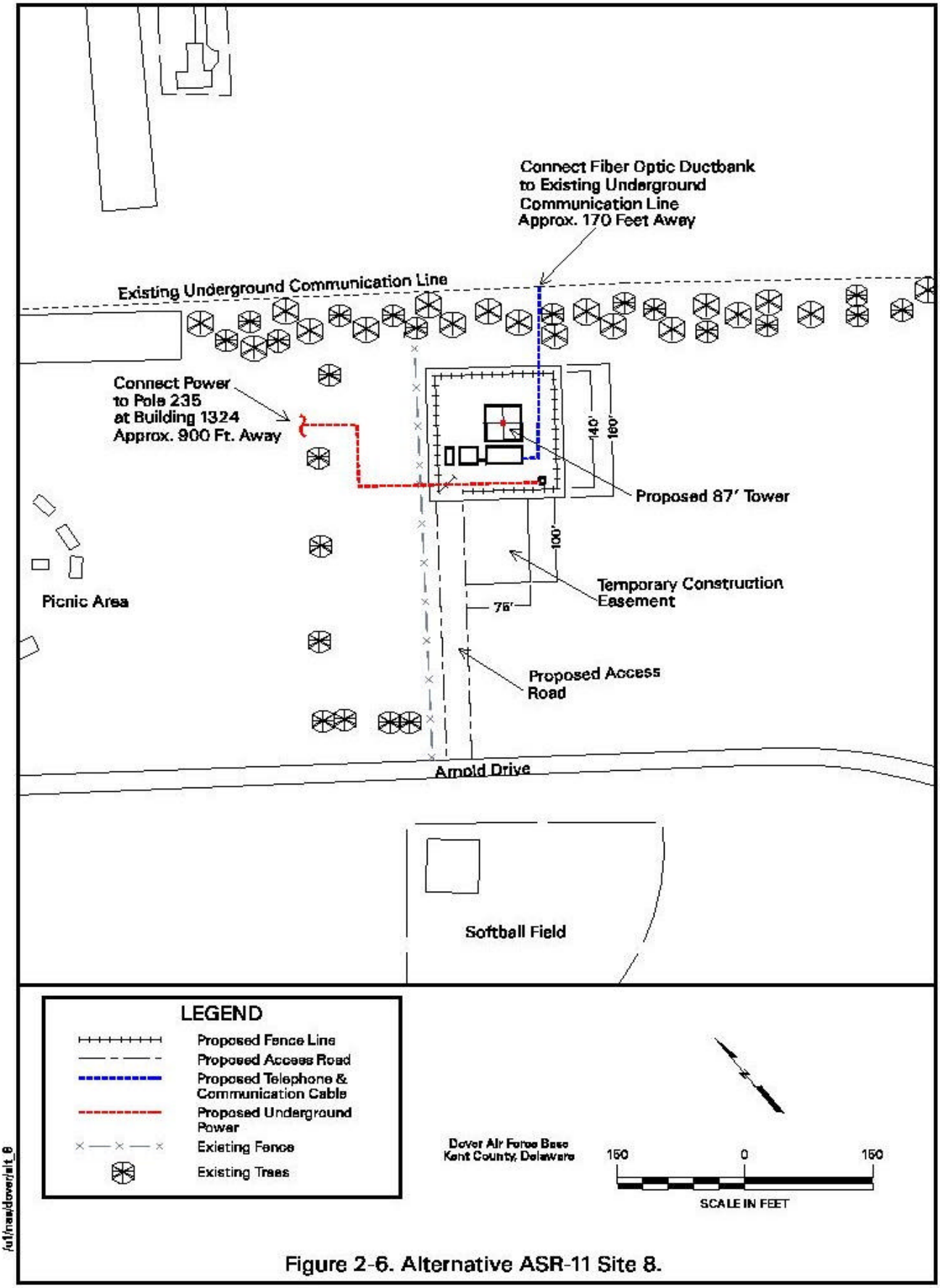


Figure 2-6. Alternative ASR-11 Site 8.

Site 2 is located on the northern side of Dover AFB, approximately 4,300 feet north of the Air Traffic Control Tower (ATCT), approximately 4,100 feet south-southwest of the end of Runway 01/19 in an area that is presently used as an obstacle course. The site is just north of the base perimeter road, in close proximity to a housing development (USAF, 1999a). Electricity can be extended from the existing Power Manhole PM-5 next to a transmitter station located 950 feet to the north. Telephone and fiber optic connections can be extended from the existing transmitter station located adjacent to the Power Manhole.

Site 5 is located 500 feet southwest of the existing AN/GPN-20 and north of Taxiway E. The site is a flat area of mowed grass within the airfield. Electricity can be extended from a high voltage distribution box located less than 100 feet to the south. Telephone and fiber optic connections can be extended from an existing manhole located 200 feet southwest of the site.

Site 8 is located in an open area 275 feet southeast of a base playground and across the perimeter road from a base family campground. Site 8 is located partially within a former trench and fill landfill utilized during the 1960s. Site 8 is also proximate to two other former landfills, LF-16 (to the north) and LF-19 (to the southwest). Previous investigations at LF-17 indicated that volatile organic compounds (VOCs) were present in the groundwater at and downgradient of LF-17, extending beneath LF-19. Data collected from LF16 (upgradient to Site 8) during various investigations indicate that LF-16 is not a source of constituents of concern (USAF, 1997a). An ROTC training area and skeet and trap range are located approximately 1,600 feet to the south. Baseball fields are located to the southwest and northeast, approximately 500 feet and 600 feet, respectively, from Site 8. Electricity can be extended from Pole 235 at Building 1324 located approximately 900 feet north of Site 8. Telephone and fiber optic connections can be extended from an existing communications line located 170 feet east of the site (USAF, 1999a).

2.2 NO ACTION ALTERNATIVE

Implementation of the No-Action alternative would result in the continued use of the AN/GPN-20 radar. Continued use and reliance on the AN/GPN-20 radar would deny Dover AFB of the improved technology offered by the new DASR system. Dover AFB would not benefit from the improved system reliability, additional weather data, reduced maintenance costs, and improved performance provided by the ASR-11 radar.

In this EA, conditions reflecting the No Action alternative are discussed for each of the twelve main environmental parameters evaluated in Chapter Three. For each parameter, the No Action alternative is characterized in the section addressing Future Baseline Without the Project.

3.0 AFFECTED ENVIRONMENT

The existing environmental conditions and future conditions without the project are described for each site in order to provide a baseline against which potential impacts related to construction or operation of the ASR-11 can be determined. General conditions on Dover AFB are presented for each of the parameters and site specific detail is included, as available. Environmental conditions at the existing AN/GPN-20 are also described in order to assess any potential issues associated with its removal. The following information was obtained from several documents/reports obtained from Dover Environmental Flight staff and supplemented with data collected during site visits conducted in the Fall of 1998.

3.1 LAND USE

The purpose of this section is to characterize land uses throughout Dover AFB and in the vicinity of the base. This section addresses land use attributes of the existing AN/GPN-20 site, as well as the alternative ASR-11 sites: Site 2, Site 5, and Site 8.

3.1.1 Existing Conditions

Dover AFB is located southeast of the City of Dover in Kent County. The existing land use west of the base is primarily commercial and industrial, with some residential areas present north of the base adjacent to the City of Dover. Existing land uses north, south, and east of the base are mostly agricultural and conservation areas (USAF, 1998b).

Land uses on Dover AFB include administrative, airfield, community, general recreation, housing (family), housing (unaccompanied), industrial, medical, outdoor recreation, and open space (Figure 3.1-1) (USAF, 1998a). The majority of the 3,900 acre base is airfield, supporting two active runways. Table 3.3-1 lists the typical land uses and facilities found on Dover AFB.

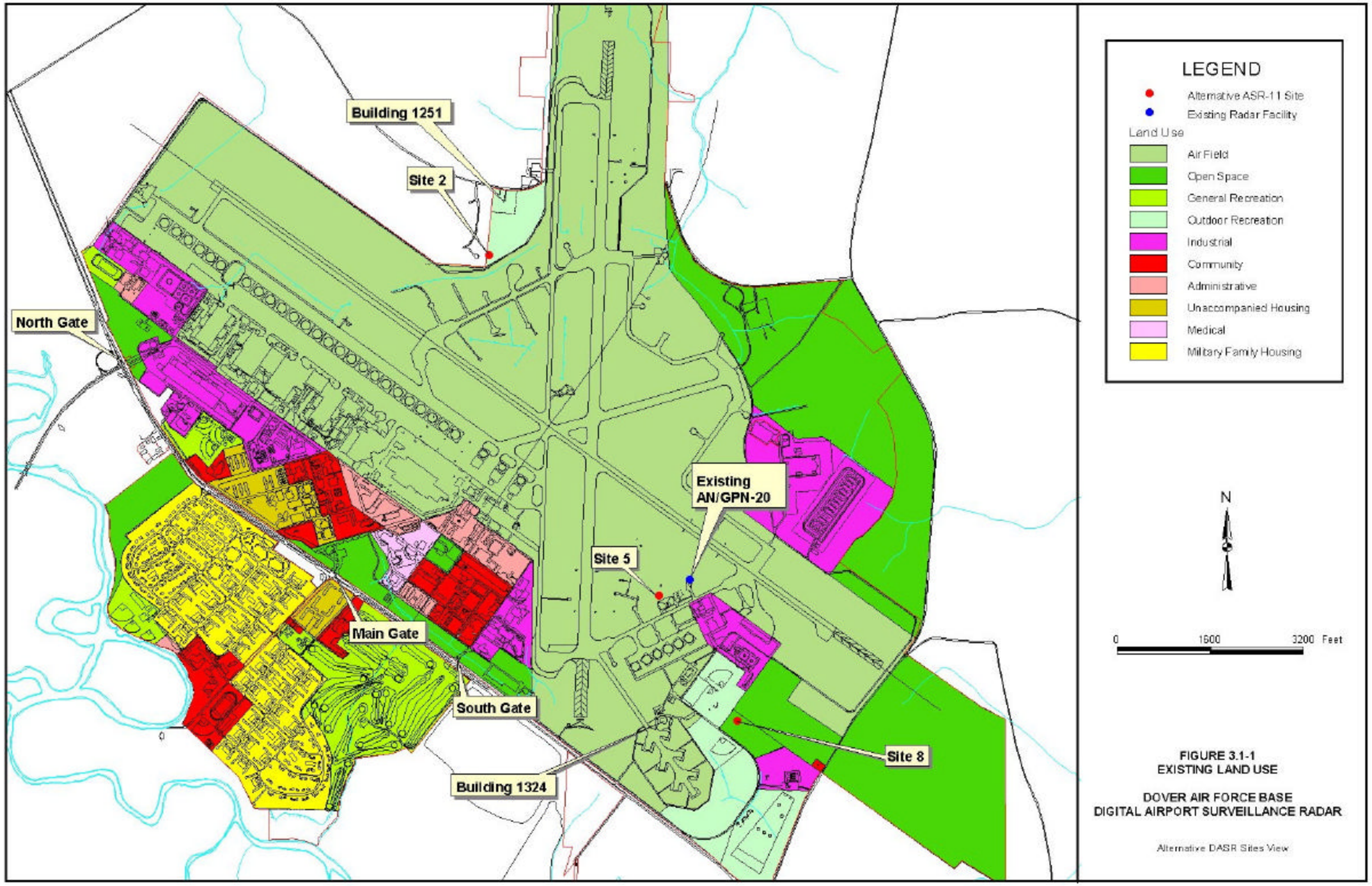

Building 1251
Site 2
North Gate
Existing
AN/GPN-20
Site 5
Main Gate
South Gate
Building 1324
Site 8
LEGEND
Alternative ASR-11 Site
Existing Radar Facility
Land Use
Air Field
Open Space
General Recreation
Outdoor Recreation
Industrial
Community
Administrative
Unaccompanied Housing
Medical
Military Family Housing
N
0
1600
3200 Feet
FIGURE 3.1-1
EXISTING LAND USE
DOVER AIR FORCE BASE
DIGITAL AIRPORT SURVEILLANCE RADAR
Alternative DASR Sites View

Table 3.1-1. Existing Land Use Descriptions at Dover AFB

Administrative	Personnel, headquarters, legal and other support activities
Airfield	Runways, taxiways, aircraft parking aprons, associated clearance and safety zones
Community	Commissary, base exchange, service stations, clubs, chapels, library
General Recreation	Playground, open field, picnic areas
Housing (Family)	Single- and multi-family housing
Housing (Unaccompanied)	Airmen dormitories, unaccompanied officer quarters
Industrial	Utility systems, building maintenance facilities, base support supply warehouse
Medical	Medical centers, hospitals, clinics
Outdoor Recreation	Swimming pools, tennis courts, golf course, soccer fields, baseball field, other facilities
Open Space	Buffer areas, out-lease areas

Source: (USAF, 1998a)

Site 2 is located between Runways 14/32 and 01/19, approximately 4,100 feet south-southwest of the end of Runway 19, just north of the base perimeter road. The existing land use is outdoor recreation and the site is presently used as an obstacle course. A residential area on Janes Road, located outside the base perimeter fence, is approximately 400 feet northwest of Site 2. The existing land use to the east, south, and west of Site 2, within base limits, is airfield. Airfield land use is primarily taxiways and runways, surrounded by mowed grass.

The existing land use at **Site 5** is airfield. It is located approximately 500 feet southwest of the existing AN/GPN-20 on mowed grass. The area surrounding the site includes runways, taxiways, the existing radar, and older aircraft aprons and hangars. Approximately 800 feet southeast of Site 5 is an aircraft museum, Building 1301, which is listed on the National Register of Historic Places (NRHP). There are a number of airplanes on display outside the building (Section 3.10, Cultural Resources, describes these resources in greater detail).

Site 8 is located on land classified as open space 275 feet southeast of a base playground and across the perimeter road from a base family campground. An ROTC training area and skeet and trap range are

located approximately 1,600 feet to the south. Baseball fields are located to the southwest and northeast, approximately 500 feet and 600 feet, respectively, from Site 8.

The existing **AN/GPN-20** is located within the airfield, approximately 500 feet northeast of Site 5, and thus is close to Building 1301 (the Air Museum), as well as the runways, taxiways, and older aircraft aprons and hangars.

3.1.2 Future Baseline Without the Project.

Future land use at **Site 2** has not been determined. Base personnel have indicated interest in potential siting of both a portable radar and a National Guard training unit in the area of Site 2 (USAF, 1999a). There are no future land use plans in the areas of **Sites 5** and **8**.

3.2 SOCIOECONOMICS

3.2.1 Existing Conditions

This section addresses the population, employment, general economic condition, and housing of Dover AFB and the surrounding area. Socioeconomic data specific to the alternative ASR-11 site locations and the existing AN/GPN-20 radar system do not exist. However, there are data for the general area surrounding and including Dover AFB.

3.2.1.1 Population. Kent County is characterized by a mixture of agribusiness and industry. The manufacturing and service sectors of the county's economy are located within the city of Dover metropolitan area, which has advantageous transportation access to Washington and Philadelphia, ninety miles away. Dover AFB is located in the southeast corner of the city of Dover, on the periphery of its urbanized land. For the most part, however, the base is immediately surrounded by farms, state and federal fish and wildlife areas, resource conservation areas, estuary reserves and tidal marshes. The continuation of family farming in the area has delayed urban encroachment from becoming a major issue at Dover AFB. Many of the farms surrounding the base are being preserved through the state's agricultural preservation law.

Between 1980 and 1990 the population of Kent County increased by 13 percent; census data from 1990 indicated a total population of 110,993. In 1996, the unemployment rate for the county was estimated at 4.5 percent (USAF, 1998a). According to the Kent County Master Plan, the urban and rural populations as of 1990 were 53 percent and 47 percent, respectively. The overwhelming majority of the county's urban population live within the City of Dover metropolitan area, with a population of 50,787. The population of Dover AFB in 1996, including active duty personnel and their dependents, was 9,604.

Site 2 is located 400 feet from an off-base, private neighborhood consisting of approximately 30 single-family homes. According to 1990 census data, the income of 40 percent of the population within this census tract is below the federal poverty level (USAF, 1999a). Neither **Site 5** nor **Site 8** is located near off-base neighborhoods.

3.2.1.2 Employment. Dover AFB is the third largest employer in the State of Delaware. As of September 1996, the total number of employees at the base including military and civilian components numbered 8,247 (USAF, 1998a). The total annual payroll was estimated at $161.5 million. In addition, the 2,418 indirect jobs created by the base contributed another $75.0 million to the community (USAF, 1998a).

3.2.1.3 Expenditures of Dover AFB. Expenses associated with the operation of Dover AFB include construction, services, and procurement of material and supplies, estimated at $105.3 million (USAF, 1998a). Table 3.2-1 provides a breakdown of annual expenditures at Dover AFB.

3.2.1.4 Housing. There are three types of housing available to all active duty personnel at Dover AFB: family housing, military dorms, and transient housing. There were a total of 1,549 family housing units provided for officers and enlisted personnel in 1995. Fifteen military dorms are located on base to house unaccompanied enlisted personnel. These facilities had a capacity of 746 enlisted personnel in 1995. Transient housing facilities are available at Dover AFB for officers (approximately 126 rooms) and enlisted personnel (approximately 204 rooms) (USAF, 1998a).

3.2.2 Future Baseline Without the Project.

It is not expected that there would be any substantial change in socioeconomic trends in the future without the project. Presently there is no indication of any changes planned on base that would substantially affect population, housing, or employment.

3.3 UTILITIES AND TRANSPORTATION

3.3.1 Existing Conditions

The utilities supplied to Dover AFB, including the area of the alternative ASR-11 sites and the existing AN/GPN-20 radar, are discussed in this section. The utilities include water supply, wastewater treatment, solid waste, electricity, telephone, and natural gas. Transportation, mainly roadway management and usage, is described in 3.3.1.7.

Table 3.2-1. Annual Expenditures at Dover AFB

Category		Expenditures ($)
Construction		
Military Family Housing		4,212,000
Military Construction Program		9,958,034
Non-Appropriated Funds		636,000
Operations and Maintenance		9,561,807
Other		14,610,000
	sub total	38,977,841
Contracts		
Service Contracts		24,000,000
	sub total	24,000,000
Miscellaneous Expenditures		
CHAMPUS		6,000,000
Base Exchange and Concessions		9,505,169
Commissary		24,000,000
Education (Tuition Assistance and Impact Aid)		804,825
Temporary Duty		2,059,785
	sub total	42,369,779
	TOTAL	105,347,620

Source: Dover AFB Economic Impact Analysis Fiscal Year 1996 (USAF, 1998b)

3.3.1.1 Water Supply. Dover AFB provides its own water from the Cheswold and Piney Point Aquifers via five deep water wells (A, B, C, D, E) (Figure 3.3-1). Wells A through D are the primary production wells and pump water at a rate of 2,850 gallons per minute into a 750,000 gallon holding tank adjacent to the water treatment plant (USAF, 1995c). Well E has been taken off line due to the presence of arsenic. It remains on standby for fire fighting purposes. From the holding tank the water is chlorinated using gas ejected feeders, treated with fluoride at the treatment plant, and then pumped to a 250,000 gallon aboveground holding tank. The water is treated at the well heads with chlorine and fluoride and then pumped to a 150,000 gallon above ground holding tank (USAF, 1995c).

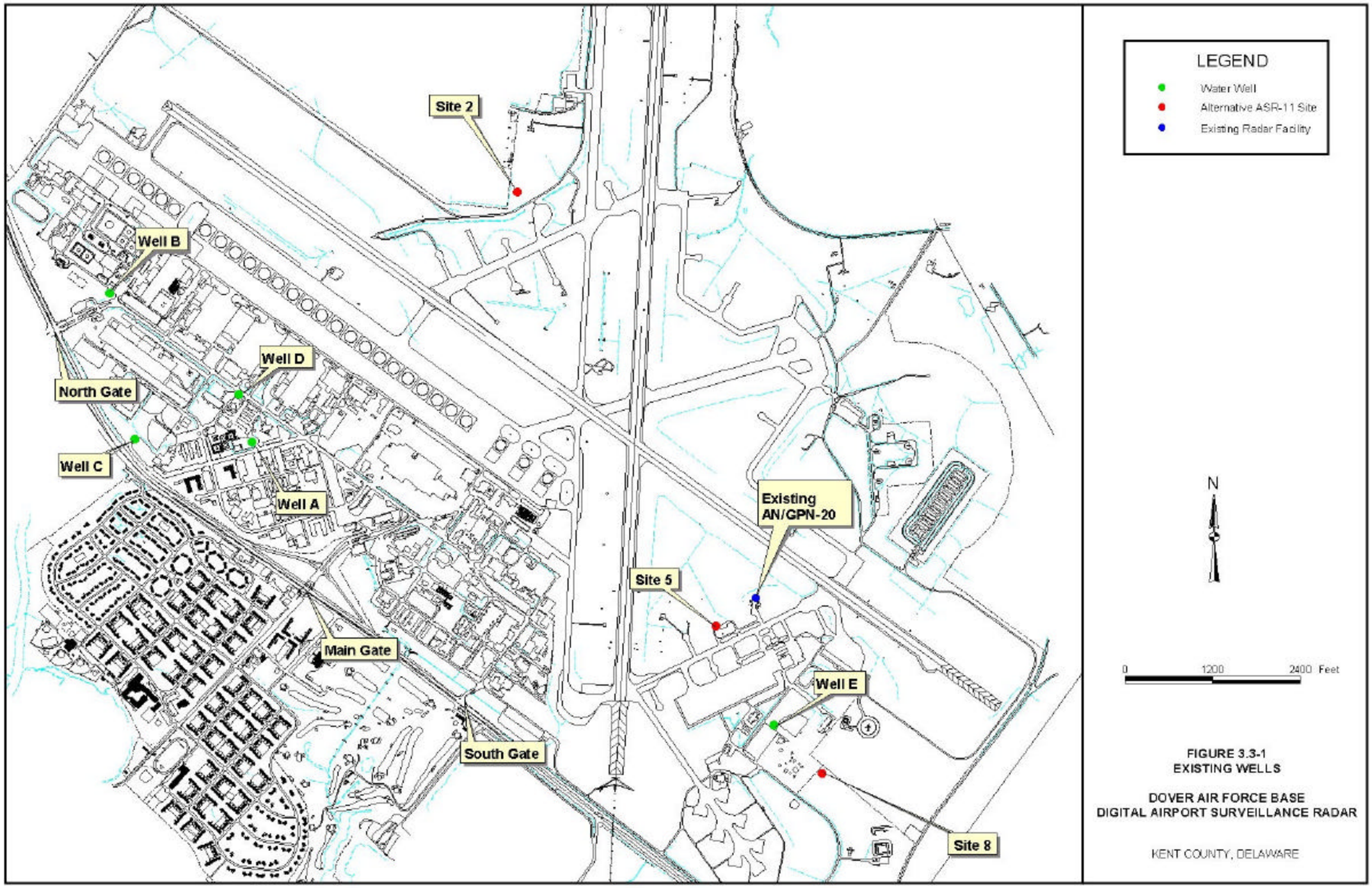


FIGURE 3.3-1
EXISTING WELLS

DOVER AIR FORCE BASE
DIGITAL AIRPORT SURVEILLANCE RADAR

KENT COUNTY, DELAWARE

3.3.1.2 Wastewater Treatment. The Dover AFB wastewater collection system is comprised of 236,412 linear feet of sewer lines and six lift stations (Figure 3.3-2). Sewage effluent collected from the base and housing communities is conveyed to the Kent County pump station on Lebanon Road west of base housing (USAF, 1995c). The sewage is then pumped to the County Treatment Plant located south of the base along the Murderkill River (USAF, 1995c).

No existing wastewater utility connections are located within the vicinity of **Site 2**. An existing wastewater connection is located approximately 470 feet southeast of **Site 5** between Taxiway E and the South Ramp. Two existing wastewater utility connections are located proximate to **Site 8;** one is located approximately 600 feet north of Site 8 at Building 1344, and the other is located approximately 900 feet northwest of Site 8 at Building 1324.

An existing wastewater utility connection is located approximately 700 feet south of the **AN/GPN-20** between Taxiway E and the South Ramp.

3.3.1.3 Solid Waste. Dover AFB has all general rubbish transported to the Delaware Solid Waste Authority Landfills in Sandtown, DE and asbestos transported to Cherry Island located in Wilmington. Waste from overseas flights has been disposed of off base in the past, however, an autoclave (steam sterilization unit) has been installed and allows for waste to be sterilized and processed on base per U.S. Department of Agriculture requirements (USAF, 1998a). This process eliminates airborne pollutants that were generated from the waste being incinerated off-base and enhances Dover AFB's waste disposal efforts. Dover AFB has a contract to recycle aluminum cans, plastic, glass, cardboard, white paper, wood, lead storage batteries, and newspapers.

3.3.1.4 Electricity. Approximately 93 percent of the electric power is supplied to Dover AFB by the City of Dover. The remainder is supplied by the Delmarva Power and Light Company to the Eagle Meadows Military Family Housing (MFH) Community (USAF, 1995c). The power arrives at Dover AFB from the City Power Plant via two 69 kV, three-phase transmission lines. One line is along Route 10 and the other parallels US 113 to the north and south substations on base. The power leaves the substations at 12,470 volts through seven feeder circuits serving principal areas of the base and is stepped down further to 120/208 volts by base transformers. All transmission and distribution lines are above ground with the exception of those in runway and airfield areas, and the Eagle Meadows MFH Community (Figure 3.3-3) (USAF, 1995c).

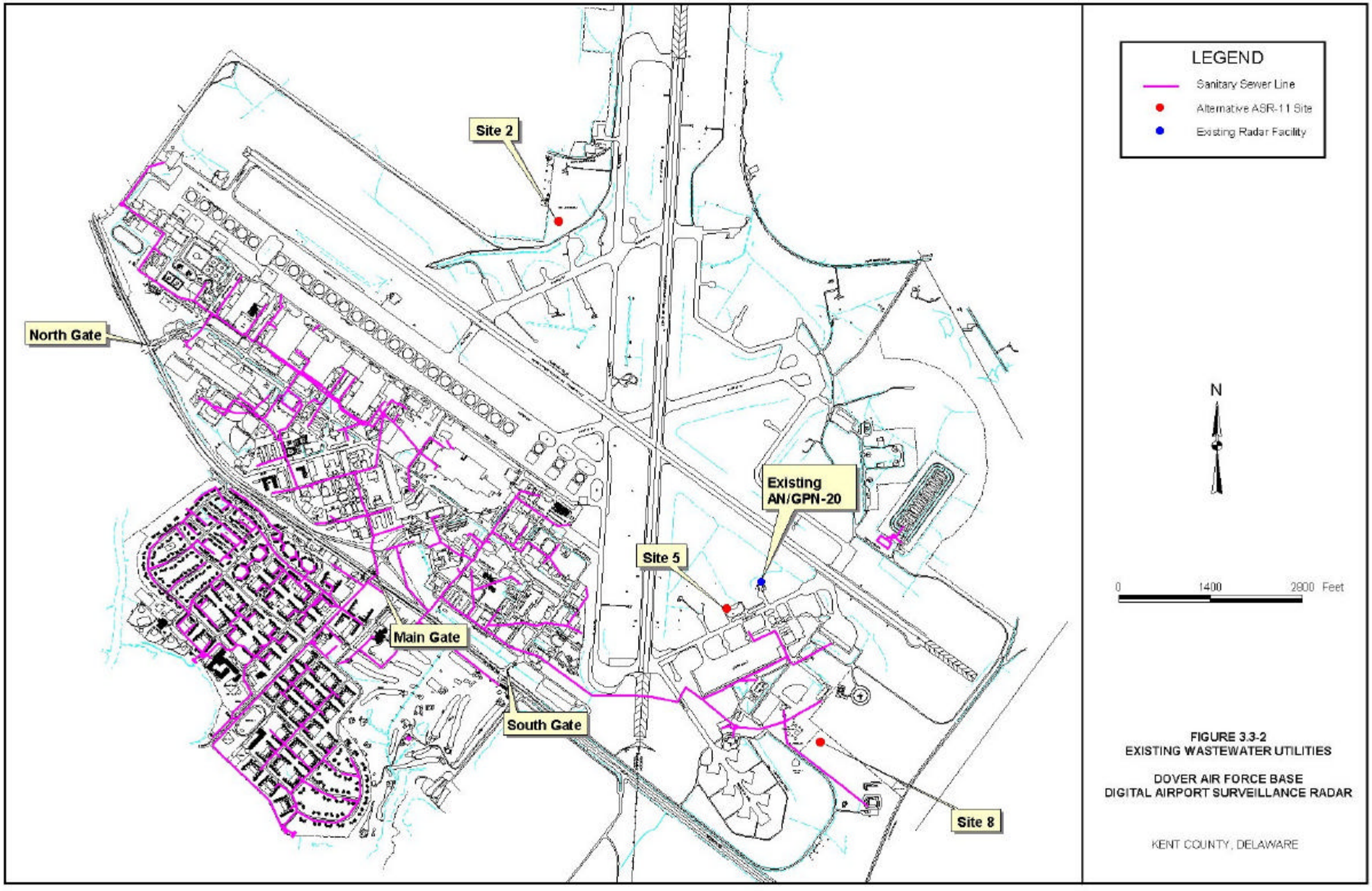
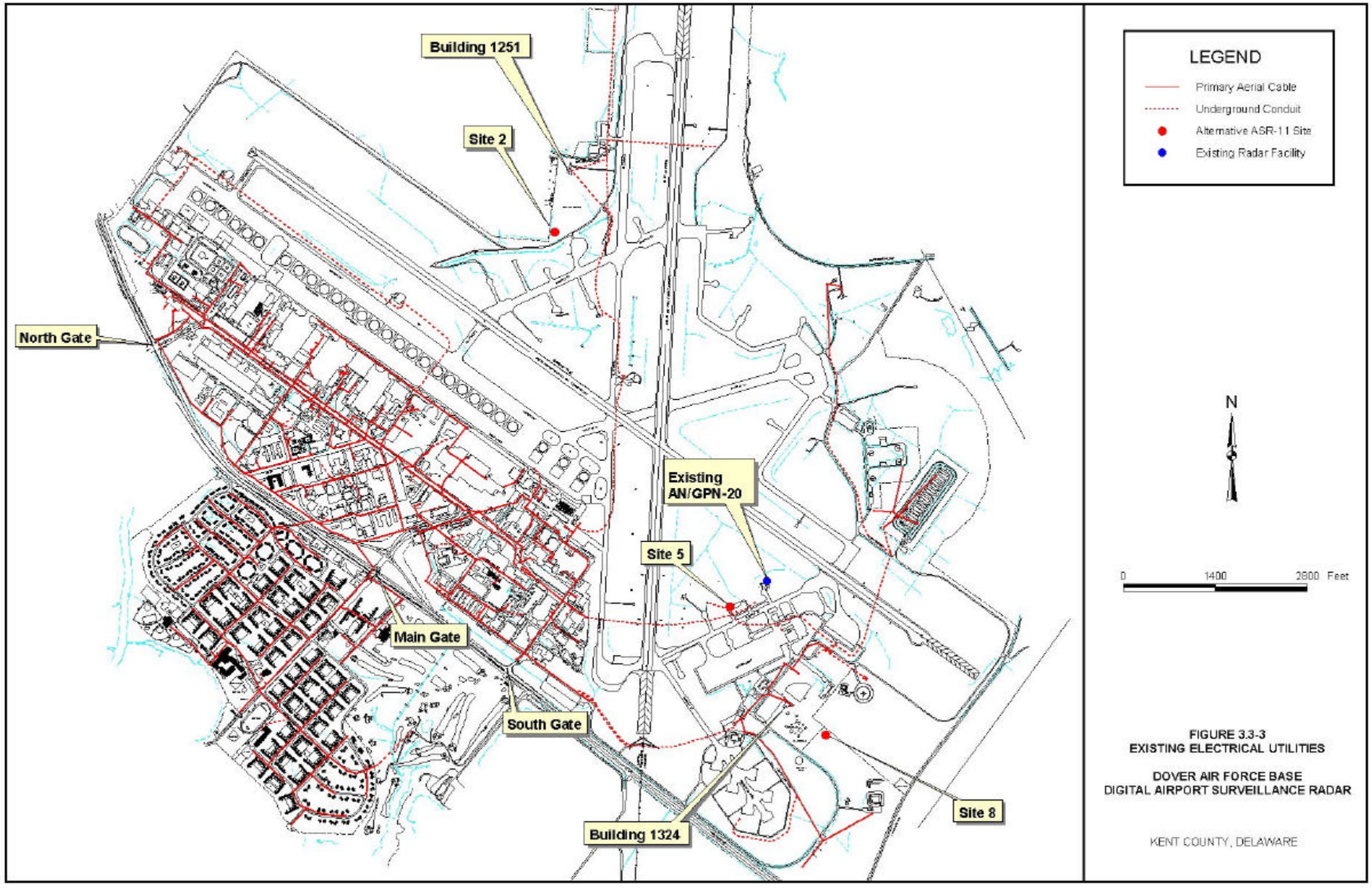


FIGURE 3.3-2
EXISTING WASTEWATER UTILITIES

DOVER AIR FORCE BASE
DIGITAL AIRPORT SURVEILLANCE RADAR

KENT COUNTY, DELAWARE


Building 1251
Site 2
North Gate
Existing
AN/GPN-20
Site 5
Main Gate
South Gate
Building 1324
Site 8
LEGEND
Primary Aerial Cable
Underground Conduit
Alternative ASR-11 Site
Existing Radar Facility
N
0
1400
2800 Feet
FIGURE 3.3-3
EXISTING ELECTRICAL UTILITIES
DOVER AIR FORCE BASE
DIGITAL AIRPORT SURVEILLANCE RADAR
KENT COUNTY, DELAWARE

Electrical power currently exists in the vicinity of each of the alternative ASR-11 sites. **Site 2** is located approximately 950 feet south of Power Manhole PM-5 next to a transmitter station (Building 1251). **Site 5** is located 100 feet north of a high-voltage distribution box. **Site 8** is located approximately 900 feet southeast of Building 1324 (USAF, 1999a). The existing **AN/GPN-20** is located approximately 260 feet northeast of an existing underground electrical conduit.

3.3.1.5 Communications. Telephone lines exist in the areas of the alternative sites. Telephone lines exist at the transmitter station 950 feet to the north of **Site 2**. Telephone lines are currently available via an existing communication manhole located 200 feet southwest of **Site 5** (USAF, 1999d). Telephone lines are located 170 feet east of **Site 8** (USAF, 1999a).

3.3.1.6 Natural Gas. Natural gas is supplied to Dover AFB by Chesapeake Utilities Corporation. The central heating plant on base uses natural gas in two of its four boilers (USAF, 1998a). The All Ranks Club kitchen and the rowhouse units in MFH also use natural gas.

3.3.1.7 Transportation. There are three gates that provide access to Dover AFB: the North, Main, and South Gates (Figure 2-2). The North Gate can be accessed from Route 10, State Route 1 (SR-1), and Route 113. It provides access to Atlantic Street, which serves as the principal connector on base. Atlantic Street links the north side of the base cantonment area with the south and serves as a connector to all three gates. The Main Gate can be accessed from SR-1 and Lebanon Road. Lebanon Road connects Eagle Heights MFH to the Main Gate by an overpass bridging SR-1. The South Gate can be accessed from SR-1, northbound and southbound. Traffic signals control traffic at the North Gate and Main Gate.

Site 2 can be accessed via the North Gate to Atlantic Street. Atlantic Street connects to Arnold Drive north of the North Gate. Arnold Drive leads to the Perimeter Road, which travels around Runway 14/32 to Site 2.

Site 5, Site 8, and existing **AN/GPN-20** can be accessed through the South Gate onto Arnold Drive south. Arnold Drive leads to Building 1301, the base museum near Site 5, and also leads to the area of the family campground and playground, which are near Site 8.

3.3.2 Future Baseline Without the Project

No substantial change in water, solid waste, telephone, natural gas, or transportation conditions would occur if the project were not completed. According to the Dover AFB General Plan, several improvements to the base electrical system have been planned (USAF, 1998a). These include replacing some of the above-ground electrical distribution lines in the area of the Base Exchange, Commissary, Head Quarter areas, and the Pax Terminal, with underground service. A long-term planning goal of the base is to eventually replace all the overhead electrical lines with underground service (USAF, 1998a). One of the sewage lift stations, Facility 850, adjacent to the shoppette and swimming pool, has also been scheduled for replacement (USAF, 1995c). This lift station is not in the area of the alternative ASR-11 sites or the AN/GPN-20.

3.4 NOISE

Existing noise environments at the three alternative ASR-11 sites and existing AN/GPN-20 are discussed in this section. Environmental noise levels from aircraft are described in terms of the day-night average sound level (L_{dn}), in units of A-weighted decibels (dBA). L_{dn} incorporates a 10 dB penalty for evening noise between 10:00 pm and 7:00 am. The L_{dn} value is used by many federal agencies to describe noise exposure and to predict the community effects of long-term exposure to environmental noise. The L_{dn} value is also used by federal agencies to determine the appropriateness of a given use of specific land (land use compatibility) relative to the average level of environmental noise experienced at that location. Air Force land use compatibility guidelines are documented in the *Air Installation Compatible Use Zone (AICUZ) Program Handbook* (USAF, 1991a). Noise levels below 65 dB are considered to be compatible with residential land use. Residential land use is discouraged for areas with noise levels in the range of 65-70 dB, strongly discouraged for areas in the range of 70-75 dB, and considered generally unacceptable for areas that exceed 75 dB.

3.4.1 Existing Conditions

Aircraft are the only significant noise source at Dover AFB. An AICUZ study was updated for Dover AFB in 1998. The study addressed safety issues and identified hazard potential due to aircraft accidents and obstructions to navigation and compatible land uses based on exposure levels to aircraft noise in the surrounding area (USAF, 1998b). Overall, the base=s noise and accident potential zones (APZs) extend approximately 1.0 mile to the north, 2.8 miles to the northeast, and 2.8 miles to the south and southwest from the base.

To analyze current noise levels resulting from Dover AFB aircraft operations, contours of constant value (isopleths) for L_{dn} values of 65, 70, 75, and 80 dB in the vicinity of the base were generated with the NOISEMAP 6.5 computer program (USAF, 1998b) (Figure 3.4-1). The L_{dn} values were computed with data on average busy-day frequency of operations for the 1998 calendar year, operational data describing flight tracks, and altitude profiles, including power settings and airspeed. These factors were combined with data on standard aircraft operational noise-emission characteristics corrected to local conditions (USAF, 1998b). Noise from surface vehicles (cars and trucks) was not included in the contours; the contribution of such sources to the total noise level is assumed to be small except in the immediate vicinity of roads.

The primary runway at Dover AFB is 01/19 which runs N/S and is 9,600 feet long; the secondary runway (14/32) runs NW/SE and is 12,900 feet long. Overflight restrictions exist over the City of Dover below 3,000 feet and overflights of historic areas are avoided (USAF, 1998a). Circling approaches are conducted east of the airfield to avoid noise sensitive areas, and departures from runway 14/32 are required to make a right turn to a heading of 360 degrees to avoid City overflights. Aircraft maintenance runups are not normally performed between 10:00 pm and 6:00 am, and generally no arrivals to runway 14/32 are permitted except for aero club aircraft (USAF, 1998a).

Site 2 is located in an area currently being used as an obstacle course. It is inside the 80 dBA aircraft noise contour, approximately 300 feet north of Taxiway C and 4,100 feet southwest of runway 01/19 and 5,000 feet northeast of runway 14/32 (Figure 3.4-1). The site is also located approximately 400 feet southeast of an off-base residential development composed of approximately 30 single-family homes (USAF, 1999a). Site 2 is not affected by any substantial amounts of ground vehicular traffic. The ambient noise level is fairly quiet, with the exception of significantly elevated noise levels when jet aircraft take off and land on the adjacent runways.

Site 5 is located inside the 80 dBA aircraft noise contour, approximately 250 feet north of Taxiway E, 1,100 feet southwest of runway 14/32, and 1,200 feet east of runway 01/19 (Figure 3.4-1). Site 5 is also located approximately 500 feet southwest of the existing AN/GPN-20 radar.

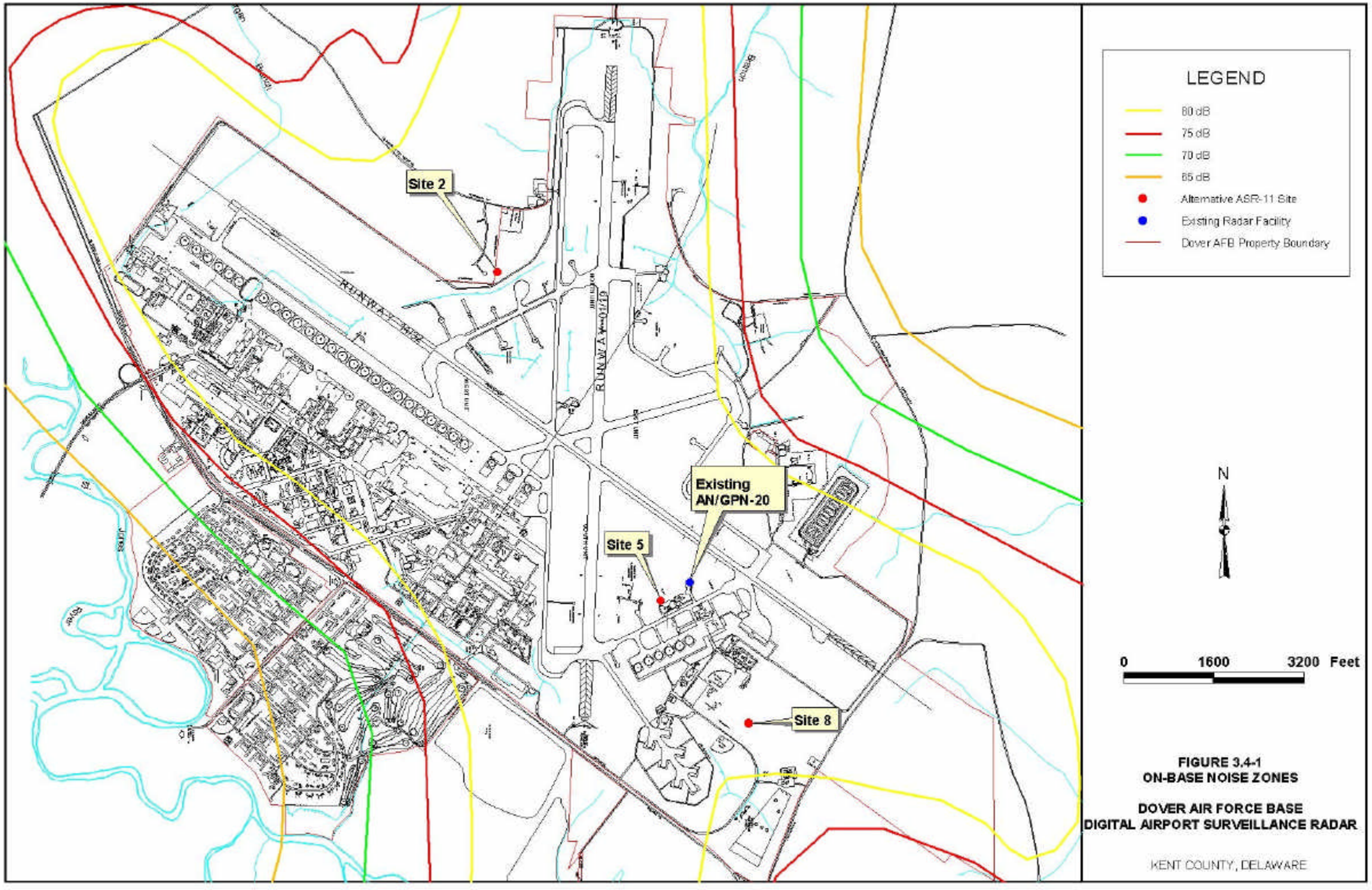


FIGURE 3.4-1
ON-BASE NOISE ZONES

DOVER AIR FORCE BASE
DIGITAL AIRPORT SURVEILLANCE RADAR

KENT COUNTY, DELAWARE

Site 8 is located inside the 80 dBA aircraft noise contour, 2,200 feet from the end of runway 14/32, 3,000 feet southeast of the end of runway 01/19, and approximately 2,700 feet south of the existing GPN-20 radar (Figure 3.4-1). This site is surrounded by a grassy area adjacent to a base playground, and across the street from the base family campground. Site 8 is affected by a moderate volume of ground vehicular traffic associated with the playground and camping area, and a recreational area, all of which are within 700 feet. Site 8 is also located approximately 1,000 feet north of the AChristmas Tree≅ which is an aircraft parking area leading to Taxiway F.

The existing **AN/GPN-20** is located inside the 80 dBA aircraft noise contour, approximately 500 feet northeast of Site 5, and is therefore affected by a level of ambient noise similar to that at this site.

3.4.2 Future Baseline Without the Project

It is not anticipated that there would be any substantial change in ambient noise conditions at any of the sites in the future without the project, although moderate increases in ambient noise levels may be associated with expanded or relocated base activities. Maximizing the use of runway 14/32 has been identified as a significant operational objective for Dover AFB (USAF, 1998a).

3.5 AIR QUALITY

3.5.1 Existing Conditions

Existing air quality characteristics in the vicinity of the three alternative ASR-11 sites and existing AN/GPN-20 are discussed in this section. Regional data, which are expected to characterize each of the alternative sites and the AN/GPN-20, are described. The Environmental Protection Agency (EPA) defines ambient air in 40 CFR Part 50, as Athat portion of the atmosphere, external to buildings, to which the general public has access.≅ In compliance with the 1970 Clean Air Act (CAA) and the 1977 and 1990 Clean Air Act Amendments (CAAA), EPA has promulgated ambient air quality standards and regulations. The National Ambient Air Quality Standards (NAAQS) were enacted for the protection of the public health and welfare, allowing for an adequate margin of safety (Table 3.5-1). To date, EPA has issued NAAQS for six criteria pollutants: carbon monoxide (CO), sulfur dioxide (SO_2), ozone (O_3), nitrogen

Table 3.5-1. National and Delaware Ambient Air Quality Standards

POLLUTANT	FEDERAL STANDARDS		DELAWARE STANDARDS*
	Primary Standard	Secondary Standard	Secondary Standard
Sulfur dioxide (SO_2)			
annual arithmetic mean[4]	80 ì g/m^3 (0.03 ppm[1])[2]	No secondary standard	No secondary standard
maximum 24-hour average[5]	365 ì g/m^3 (0.14 ppm)[2]	No secondary standard	No secondary standard
maximum 3-hour average[5]	None	1300 ì g/m^3 (0.50 ppm)[2]	1300 ì g/m^3 (0.50 ppm)
Particulate Matter (PM-10[a])			
24-hour average[5]	150 ì g/m^3	Same as primary standard	Same as federal primary standard
annual arithmetic mean[4]	50 ì g/m^3	Same as primary standard	Same as federal primary standard
Carbon Monoxide (CO)			
8 hour average[5]	9 ppm (10 mg/m^3)	No secondary standard	No secondary standard
1 hour average[5]	35 ppm (40 mg/m^3)	No secondary standard	No secondary standard
Ozone (O_3)			
1 hour average[6]	0.12 ppm (235 ì g/m^3)	Same as primary standard	No secondary standard
Nitrogen Dioxide (NO_2)			
annual arithmetic mean[4]	0.053 ppm (100 ì g/m^3)	Same as primary standard	No secondary standard
Lead (Pb)			
Calendar quarter max. arithmetic mean[4]	1.5 ì g/m^3	Same as primary standard	No secondary standard
Total Suspended Particulates (TSP)			
annual arithmetic mean[4]	No primary standard	No secondary standard	75 ì g/m^3 (primary); 60 ì g/m^3
maximum 24-hour average[5]	No primary standard	No secondary standard	260 ì g/m^3 (primary); 150 ì g/m^3

* Delaware Ambient Air Quality Primary Standards are the same as the NAAQS

[a]"*particles with an aerodynamic diameter less than or equal to a nominal 10 micrometers*" (40 CFR 50)

[1]ppm=parts per million

[2]approximate equivalent value in either ì g/m^3, mg/m^3 or ppm

[4]not to be exceeded

[5]not to be exceeded more than once a year

[6]not to be exceeded more than one day per year

Source: EPA, 1998 and DNREC, 1999

dioxide (NO_2), lead (Pb), and particles with a diameter less than or equal to a nominal 10 micrometers (PM_{10}). National primary standards are set to protect human health with an adequate margin of safety for even the most sensitive portion of the human population. Secondary standards are set for some pollutants to protect against damage to plants, animals, and materials. Delaware Ambient Air Quality Standards are the same as the NAAQS with the exception of total suspended particulates (TSP) (DNREC, 1999). The Delaware Department of Natural Resources and Environmental Control (DNREC) regulates the air program on base under the Clean Air Act Amendments of 1990 (USAF, 1998a).

Ambient concentrations in excess of these standards are a violation of the law and can lead to a designation of Anonattainment≅. Standards are not to be exceeded more than once per year, except for O_3 and PM_{10}, which are not to be exceeded more than an average of one day per year. Kent County, including Dover AFB, is in a severe nonattainment area for ozone as is most of the Mid-Atlantic coastal area (USAF, 1999a).

Common air emissions sources on base are boilers, backup generators, painting operations, the aircraft engine test cell, and fuel dispensing/storage. These emissions fall under a Title V Air Operating permit, which Dover AFB submitted in January, 1997 (USAF, 1999a). The estimated 1994 emissions in tons per year from Dover AFB and Kent County as a whole are summarized in Table 3.5-2. Volatile organic compounds (VOCs) from the commuter traffic at Dover AFB were estimated at 36.83 tons/year and NO_x at 24.01 tons/year, which are included in the numbers presented in Table 3.5-2 (USAF, 1999a).

Table 3.5-2. Pollutant Emission Quantities, 1994 Data

	Dover AFB (tons/year)	**Kent County (tons/year)[1]**
Particulate Matter (PM_{10})	31.49	NA
Nitrogen Oxides (NO_x)	1082.92	65.233
Carbon Monoxide (CO)	1519.94	NA
Volatile Organic Compounds (VOCs)	507.72	25.233
Sulfur Dioxide (SO_2)	224.77	NA
Hazardous Air Pollutants (HAPS)	86.85	NA

[1]VOCs and No_x are precursors for ozone and are the emissions of concern under the federal implementation plans in an area of severe non-attainment for ozone, which is the status of Kent County.

Activities at Dover AFB that could potentially affect the air quality in the vicinity of the three alternative ASR-11 sites and existing AN/GPN-20 include vehicular traffic, and activities associated with aircraft and runway operations, such as aircraft and equipment maintenance and jet engine testing and operation.

3.5.2 Future Baseline Without the Project

The air quality in the vicinity of the three ASR-11 sites is expected to improve as a result of ongoing efforts to reduce emissions at Dover AFB. Air emissions at the base should decrease in the future due to the implementation of new technologies that reduce emissions; improved maintenance of motor vehicles, aircraft, and equipment; and replacement of outdated aircraft and machinery with more efficient models that have lower emissions. There are no future realignments or closures proposed that would change base operations and air quality conditions.

3.6 GEOLOGY AND SOILS

3.6.1 Existing Conditions

General characteristics of geology (including topography) and soil resources on the base are discussed in this section. Site specific data relevant to the three alternative ASR-11 sites are provided, as available.

3.6.1.1 Geology. The topography of Dover AFB, and the surrounding area, is characterized by generally level plains, rolling uplands, streams, and forested wetlands. These characteristics are typical of the Atlantic Coastal Plain Physiographic Province in which Dover AFB lies (USAF, 1997c). The base surface elevations range from 10 feet above mean sea level (MSL) by the St. Jones River to 30 feet above MSL along runway 01/19. Both **Site 2** and **Site 5** are approximately 20 feet above MSL. **Site 8** is approximately 25 feet above MSL.

The Atlantic Coastal Plain Physiographic Province is a wide belt of Cretaceous-to-recent sedimentary deposits of sand, gravel, silt, clay, limestone, chalk, and marl (USAF, 1997b). The Coastal Plain sediments increase in thickness to the southeast, dipping an average of 15 feet per mile (ft/mi) (USAF, 1997c). The stratigraphic units at Dover AFB, from youngest to oldest, are the Columbia Formation, the Calvert Formation, and the Piney Point Formation.

The Columbia Formation, which dominates the near-surface geology in Delaware, was deposited under fluvial conditions and forms a broad sheet-like deposit of sand covering most of the State of Delaware. The thickness of the Columbia Formation varies regionally from 0 to over 100 feet, with thicknesses of 30 to over 70 feet common at Dover AFB.

The Calvert Formation, of which the Chesapeake Group is the only member present in the Dover area, underlies the Columbia Formation and is described as a gray-to-blue gray silt, with bands of light gray fine-to-medium sand. The Calvert Formation/Chesapeake Group has a thickness of approximately 290 feet in the area of Dover AFB, and contains the Frederica (upper) Aquifer and Cheswold (lower) Aquifer (USAF, 1997c).

The Piney Point Formation (the first major marine depositional period) underlies the Calvert Formation/ Chesapeake Group and consists of green fine-to-medium glauconitic sand with shells. The Piney Point Formation is a lenticular sand unit with a maximum thickness of 251 feet (USAF, 1997c).

3.6.1.2 Soil Resources. The predominant soil group found on Dover AFB is the Sassafras-Fallsington Association (USAF, 1997b). Surface soils found on Dover AFB also include the Othello-Matapeake-Mattapex Association and the Tidal Marsh Association.

The portions of Dover AFB developed prior to 1971 are not mapped in the Kent County Soil Survey; soil survey data are available only for proposed **Site 2** (USAF, 1998c). Site 2 is located on Fallsington loam, a listed hydric and prime farmland soil, which is poorly drained and composed primarily of old, sandy sediment. Farming is not possible unless the soil is properly drained. Once adequately drained, as Site 2 currently is, the soil is considered prime farmland (USAF, 1999a). Engineering limitations for undisturbed Fallsington loam are listed as severe, due to high water table and frost action (USAF, 1999a). Site 2 is a well-drained grassy field area which is mowed regularly.

No soil mapping data are available for **Site 5**. However, due to the regrading activities associated with the construction of the adjacent runways and taxiways, the soils would most likely be classified as urban or disturbed soils. A field review revealed that the site is a mowed field area, which is well drained via a network of drainage ditches (USAF, 1999a).

Although no soil mapping data are available for **Site 8**, it is located adjacent to a large area of Mattapex silt loam, as well as a smaller area of Sassafras loam. Mattapex is a deep, moderately drained soil formed on silty mantle underlain by older, coarser material. These soils are not difficult to work with except when excessively dry or wet. Engineering interpretation charts list Mattapex as a soil with fair stability and a moderately high water table with potential for severe frost action. Sassafras is listed as a deep well-drained soil composed of very old sandy sediments. Since Site 8 was utilized as a landfill (See Section 3.11), alternating layers of local soil and general refuse are likely to be present between 2-8 feet below ground surface (USAF, 2000).

No soil mapping data are available for the existing **AN/GPN-20** which is located 500 feet northeast of Site 5.

3.6.2 Future Baseline Without the Project

The geology and soil conditions at the base are not expected to change in the future without the project. It is expected that current conditions will continue to represent the area of the alternative ASR-11 sites and existing AN/GPN-20 radar system.

3.7 SURFACE WATER AND GROUNDWATER

3.7.1 Existing Conditions

The surface water and groundwater at the three alternative ASR-11 sites and the site of the AN/GPN-20 are discussed in this section. The data for the surrounding area are expected to generally characterize the alternative ASR-11 sites and the area of the AN/GPN-20.

3.7.1.1 Surface Water. The surface hydrology of the area now occupied by Dover AFB originally consisted of a natural network of slow draining wetlands and channels. After the construction of the base, many of the major drainage pathways were modified by the construction of drainage ditches (USAF, 1997c). As a result, the base is now well drained and is not subject to flooding (USAF, 1998c).

Dover AFB lies within two watersheds, the Little River and the St. Jones River, with runway 14/32 marking the surface water drainage divide. Surface water in the northern part of the base flows northeasterly through the north drainage ditch (SD12), then under runway 01/19, and discharges to the Pipe Elm Branch of the Little River. In the extreme northwest, surface water drains to the Morgan Branch of the Little River.

West of Atlantic Avenue, surface water runoff is transported in buried drain pipes that discharge to an open ditch immediately east of Route 113. Runoff in this ditch flows under the highway, through the base golf course via an unnamed stream, to the St. Jones River. The southernmost portion of the base drains via two drainage pathways which discharge to the St. Jones River. Most of the runoff flows west to a drainage ditch approximately 4,400 feet south of the Golf Course stream; the other drainage ditch directs water south of the base toward Route 9 (USAF, 1997c). A small area on the east side of the base, which includes the munitions storage area, drains to the Lewes ditch which eventually discharges to Delaware Bay.

Site 2 is located approximately 500 feet east of drainage ditch SD12, and 3,000 feet from Pipe Elm Branch. Ditch SD12 is approximately 40 feet wide, 15 feet deep, and 8,500 feet long (USAF, 1997c). Weeds, tall grasses, and small trees grow along the sides and bottom of the ditch. **Sites 5**, **8,** and the existing **AN/GPN-20** are located at relatively long distances north of the St. Jones River. During a site visit in October 1998 no surface water was observed at any of the alternative sites proposed for ASR-11.

Non-point source pollution is a concern at Dover AFB. For new construction projects, the base is considering the use of alternative solutions to manage stormwater runoff and to limit discharge to preconstruction rates. Alternatives include providing on-site detention (dry ponds), or using porous pavement for parking areas (USAF, 1995c). The installation of a centralized aircraft de-icing facility at the base is also under consideration. A drive-through boom would be placed at a location where the majority of aircraft travel prior to departure. A recovery system would be included to allow the capture and recycling of the de-icing product, thereby removing a source of stormwater contamination (USAF, 1998a).

In October 1995, Dover AFB was issued an NPDES stormwater multi-sector general permit for industrial activities. Control of stormwater from industrial activities is implemented under three sections of the permit. These three sections address: hazardous waste treatment, storage, or disposal facilities; scrap recycling and waste recycling facilities; and vehicle maintenance, equipment cleaning, or deicing areas located at the Air Transportation Facilities. All three sections require a Stormwater Pollution Prevention Plan (SWPPP) and Sampling Plan. The SWPPP for Dover AFB was developed in April 1995 (USAF, 1999b). Stormwater is collected in the drainage system and discharged to both the Pipe Elm Branch and the St. Jones River.

3.7.1.2 Groundwater. There are four major hydrogeologic units underlying Dover AFB: one surface aquifer, the Columbia; one semiconfined aquifer, the Frederica; and two confined aquifers, the Cheswold and the Piney Point; (USAF, 1997d). Of particular significance to the base are the Columbia and Frederica aquifers. Because they are found at or near the ground surface, these aquifers are subject to contamination (USAF, 1995c).

The Columbia aquifer is the surficial aquifer for most of Delaware, and varies in saturated thickness from a few feet in the northern part of the state to over 180 feet in the south. It is used as a source of irrigation water and domestic water supply throughout most of the state (USAF, 1997c). The recharge area for the Columbia aquifer includes the entire base. Currently, groundwater contamination at Dover AFB is confined to the Columbia aquifer, which is not used for drinking water at the base (USAF, 1998a).

The Frederica aquifer is located beneath a silty clay confining layer (Kirkwood Formation) which separates it from the Columbia aquifer. Its physical characteristic is principally sand and gravel. Recharge of the Frederica aquifer occurs in its subcrop area north of the city of Dover, where sands are directly overlain by the Columbia Formation. The Frederica aquifer is not generally used as a drinking water source (USAF, 1997d).

The Cheswold aquifer is found at a depth of approximately 125 feet below ground surface at Dover AFB, and is separated from the Frederica aquifer by a confining layer of silt, clay, and sand, approximately 90 feet thick. Recharge of this aquifer occurs in its subcrop area northwest of Dover and by vertical leakage through the overlying Calvert Formation. Beneath the Cheswold aquifer, separated by a silty confining bed, lies the Piney Point Aquifer. Recharge of this aquifer is by vertical leakage through the Calvert Formation (USAF, 1997d).

The Cheswold and Piney Point aquifers serve as the primary water supply for the city of Dover, Dover AFB, and the major industries within the greater Dover area. Dover AFB has its own water supply, which is drawn from seven wells screened in the Cheswold and Piney Point Aquifers ranging from 185 to 560 feet below ground surface, and capable of producing 2,850 gallons per minute (USAF, 1998a).

Based on available groundwater contour mapping, the average water table depth in the vicinity of **Site 2** is 8-10 feet below ground surface (bgs)(USAF, 1997c), and at **Site 5** and **Site 8** is 8-14 feet bgs. Seasonally high groundwater (6-8 feet bgs) has been reported at Site 2 due to higher than average rainfall, as well as the influence of drainage ditch SD12. The drainage ditch, which is approximately 500 feet west of Site 2

influences the direction of groundwater flow in the shallow portion of the aquifer. Shallow groundwater flows toward the ditch within a distance of approximately 1,200 feet.

The average water table depth in the vicinity of the existing **AN/GPN-20** is 8-14 feet bgs (USAF, 1997a).

3.7.2 Future Baseline Without the Project

Surface water conditions are expected to improve in the future with the implementation of the SWPPP BMPs. The construction of a centralized aircraft de-icing facility would also contribute to an improvement in surface water quality. Groundwater quality conditions are also expected to improve as a result of basewide stormwater BMPs.

3.8 BIOLOGICAL RESOURCES

3.8.1 Existing Conditions

This section contains descriptions of biological resources, including vegetation, wetlands, and wildlife for Dover AFB and its vicinity, including the proposed ASR-11 sites and the existing AN/GPN-20 site.

3.8.1.1 Vegetation. Dover AFB is located within the Oak-Pine Forest Region within the Atlantic Coastal Plain. The majority of the base was cleared of forest for agriculture, prior to the development of the base. The grounds on base today are maintained as landscaped property. Of the 3,268 acres comprising Dover AFB, only 130 acres of native woodland and wetland remain. The rest of the base is semi-improved and improved lawns, open fields, and impervious surfaces (USAF, 1997d). Grass species most commonly found on base are fescue (*Festuca* sp.), bluegrass (*Poa pratensis*), redtop (*Agrostis alba*), and various broadleaf species (see Table 3.8-1).

A biological inventory of Dover AFB was conducted between July 1990 and August 1991 by the Delaware Natural Heritage Inventory (DNHI) of the Division of Parks and Recreation, Department of Natural Resources and Environmental Control to identify, document, and maintain biological diversity. The inventory identified several areas that continued to support native vegetation. Some of the areas have been disturbed or degraded to various levels, including the areas of the three alternative DASR sites and AN/GPN-20. All three alternative ASR-11 sites and the existing AN/GPN-20 are located on upland grasslands consisting of mixed grasses resembling those listed for grasslands in Table 3.8-1.

Table 3.8-1. List of Species in Dry Meadow and Grassland Habitats on Dover AFB

Common Name	Scientific Name
Fescue	*Festuca* spp.
bluegrass	*Poa pratensis*
redtop	*Agrostis alba*
broomsedge	*Andropogon virginicus*
giant foxtail	*Setaria faberi*
panic grasses	*Panicum* spp.
Queen Anne=s lace	*Daucus carota*
Goldenrods	*Solidago* spp.
asters	*Aster* spp.
yellow passion flower	*Passiflora lutea*

Source: USAF, 1997d

3.8.1.2 Wetlands. A partial jurisdictional wetland survey completed at Dover AFB in 1992 identified wetlands in three areas: within and immediately adjacent to the Pipe Elm Branch in the northeastern area of the base; immediately around IRP site LF-13 (rubble fill) located east of the airfield; and adjacent to the golf course and the St. Jones River (USAF, 1997d). Seventeen acres were delineated in the vicinity of Pipe Elm Branch, 9.2 acres adjacent to LF-13, and 17 acres on the golf course and along the St. Jones River (USAF, 1997d). The delineated areas are not in the vicinity of the alternative DASR sites or AN/GPN-20. The alternative DASR sites and AN/GPN-20 are upland, grassy areas and do not include wetlands.

Floodplain areas are along the St. Jones River where it borders the base and in areas in the golf course along an unnamed drainage into the St. Jones River (USAF, 1997d). No floodplain areas are located in the vicinity of the three alternative DASR sites or the AN/GPN-20.

3.8.1.3 Wildlife. The abundance and diversity of wildlife on Dover AFB is low due to extensive development and the degradation of natural habitats. Surveys conducted in 1990-91 identified 45 species of fish (22 freshwater species, 23 tidal species), nine species of butterflies (the only insect surveyed), and 51 species of birds (23 neotropical migrants). The fauna observed and fauna possible in suitable habitats on base in the areas of the alternative DASR sites and AN/GPN-20 are discussed below.

Upland meadow and grassland habitats, such as that present at the alternative DASR sites and AN/GPN-20, may provide breeding habitat for common species such as American toad (*Bufo americanus*), eastern

garter snake (*Thamnophis sirtalis*), eastern cottontail (*Sylvilagus floridanus*), eastern meadowlark (*Sturnella magna*), and grasshopper sparrow (*Ammodramus savannarum*) (USAF, 1997d).

Bird Aircraft Strike Hazard (BASH) is an operational concern on Dover AFB because the base is located in close proximity to migratory and overwintering sites for waterfowl. Bird species that are of primary concern are Canada geese, snow geese, sea gulls, and flocks of starlings and blackbirds (USAF, 1997d). Dover AFB, similar to other bases, has two phases for BASH, Phase I and Phase II. Phase I conditions are when there is a low hazard, and during these times routine prevention measures are carried out, including airfield grass height maintenance, habitat modification, and airfield drainage ditch maintenance. During Phase II conditions, when BASH potential is high, the following measures are conducted: operational restrictions on arriving and departing aircraft, limitation of low-level operations, use of the AN/GPN-20 as a bird watch radar, and use of harassments such as bird scare cartridges and distress tapes (USAF, 1997d). Dover AFB changes from Phase I to Phase II BASH operations only when the hazard increases.

3.8.1.4 Threatened and Endangered Species. The survey conducted by DNHI in 1990-91 indicated that there are no federally listed or candidate plant or fauna species on base. There are, however, six plant and six fauna species that are of State Special Concern (Table 3.8-4) (USAF, 1997d). Most of the plant and fauna species were found along or in the St. Jones River and the Pipe Elm Branch, or drainage swales within the military family housing area, west of the base. Three plant species were observed along the eastern edge of the base within the Old Stand Timber area and the broad-winged hawk is also know to breed in that area (USAF, 1998a). None of these areas are near the alternative DASR sites or AN/GPN-20. Therefore, the alternative DASR sites and AN/GPN-20 are not believed to provide habitat for protected species.

3.8.2 Future Baseline Without the Project

Without the project, the status of vegetation, wetlands, wildlife, and threatened and endangered species in the vicinity of the three alternative DASR sites and AN/GPN-20 is generally expected to be the same as present. Should a portable radar unit or Air National guard training unit be sited in the vicinity of Site 2, there would be the potential for limited clearing and disturbance of wildlife habitat. There is no planned change in land use for the locations of Sites 5 and 8 which would alter the current characteristics of biological resources in this area.

Table 3.8-4. List of State Special Concern Species

Scientific Name	Common Name	State Rank*
Fauna		
Acantharcus pomotis	mud sunfish	S2
Apeltes quadratus	four spine stickleback	S1
Ardea herodias	great blue heron	S1B
Asio flammeus	short-eared owl	SHB, S2N
Bartramia brevicauda	upland sandpiper	S1
Buteo platypterus	broad-winged hawk	S2B, S4N
Plants		
Bidens coronata	tickseed sunflower	S2
Euthamia microcephala	tiny headed goldenrod	S2
Phyla lanceolata	green frog-fruit	S1
Stachys hyssopifolia	hyssop-leaf hedge-nettle	S1
Carex typhina	cattail sedge	S2
Passiflora lutea	yellow passionflower	S2

*Ranking criteria:
S1 - 5 or fewer occurrences statewide, extremely rare
S2 - 6 to 20 occurrences statewide, very rare
S4 - 100 or more occurrences statewide, common
SH - historically known from the state, but not verified for an extended period, usually 15 years
B, N - B and N qualifiers used to indicate breeding and non-breeding status
Source: USAF, 1993; USAF, 1997d

3.9 AESTHETIC RESOURCES

The purpose of this section is to characterize the aesthetic resources of the project area in order to provide a framework for determining the potential changes that could occur as a result of construction and operation of the ASR-11 at the alternative sites.

3.9.1 Existing Conditions

Dover AFB is located in the center of the Delmarva Peninsula between the Delaware and Chesapeake Bays, within one of the state's prime agricultural areas. The surface topography is relatively flat, with elevations ranging from approximately 10 feet above MSL by the St. Jones River to 30 feet above MSL along runway 01/19. **Site 2**, **Site 5**, and the existing AN/GPN-20 are approximately 20 feet above MSL. **Site 8** is approximately 25 feet above MSL.

Site 2 is located in the northwest portion of Dover AFB approximately 4,100 feet south-southwest of the end of the N/S runway (runway 01/19), and 6,500 feet northwest of the existing GPN-20 radar. The site is a mowed grassy field, in an area currently used as an obstacle course, just north of the base perimeter road. The site is adjacent to an off-base, private community composed of approximately 30 single-family homes (USAF, 1999a). Figure 3.9-1 shows the locations from which photographs were taken during a site survey in October 1998. A view of Site 2 looking north is shown in Photograph A, Figure 3.9-2. The site is located approximately where the green tent is shown in the foreground of Photograph A. The small white building, surrounded by poles, in Photograph A is Building 1251, the Transmitter Station. Photograph B, Figure 3.9-2, shows the view of the site looking west with the existing obstacle course in the foreground, and the off-base housing partially visible in the background.

Site 5 is a mowed grassy field located approximately 500 feet southwest of the existing AN/GPN-20 radar, and 3,000 feet west of the end of runway 14/32. In addition to the runways, taxiways, and AN/GPN-20 radar, the land surrounding Site 5 includes older aircraft aprons and hangers, including Building 1301, a NRHP site which houses the Air Museum. Building 1301 is approximately 800 feet southeast of Site 5 (USAF, 1999a). Figure 3.9-3 shows the locations from which photographs were taken during a site survey in October 1998. A view of Site 5 looking southwest is shown in Photograph A, Figure 3.9-4. Photograph B, Figure 3.9-4 shows a view of the site looking east.

Site 8 is located in the southeast portion of Dover AFB approximately 2,700 feet south of the existing AN/GPN-20 radar, and 2,200 feet south of the end of the runway 14/32. The site consists of a regularly mowed grassy area, located between the recreational fields, base playground, family camping area, Reserve Officers Training Course (ROTC) facility, and rifle range. The terrain surrounding Site 8 gently slopes up from the perimeter road. Two 4 foot by 4 foot concrete well heads/vent shafts are located northwest of the site, backed by a large tree line. Trees between 50 and 60 feet high flank the northeast edge of the proposed site (USAF, 1999a). Figure 3.9-5 shows the locations from which photographs were taken during a site survey in October, 1998. A view of Site 8 (which is on the right side of the fence) looking northeast toward the tree line is shown on Photograph A, Figure 3.9-6. Photograph B, Figure 3.9-6 shows the view looking east toward the site (which is on the opposite side of the fence). The Delaware State Historic Preservation Office has expressed concern that Site 8 may be visible form several historic properties in the vicinity. These include the John Wesley Cemetery, the Dickinson Plantation, and the St.

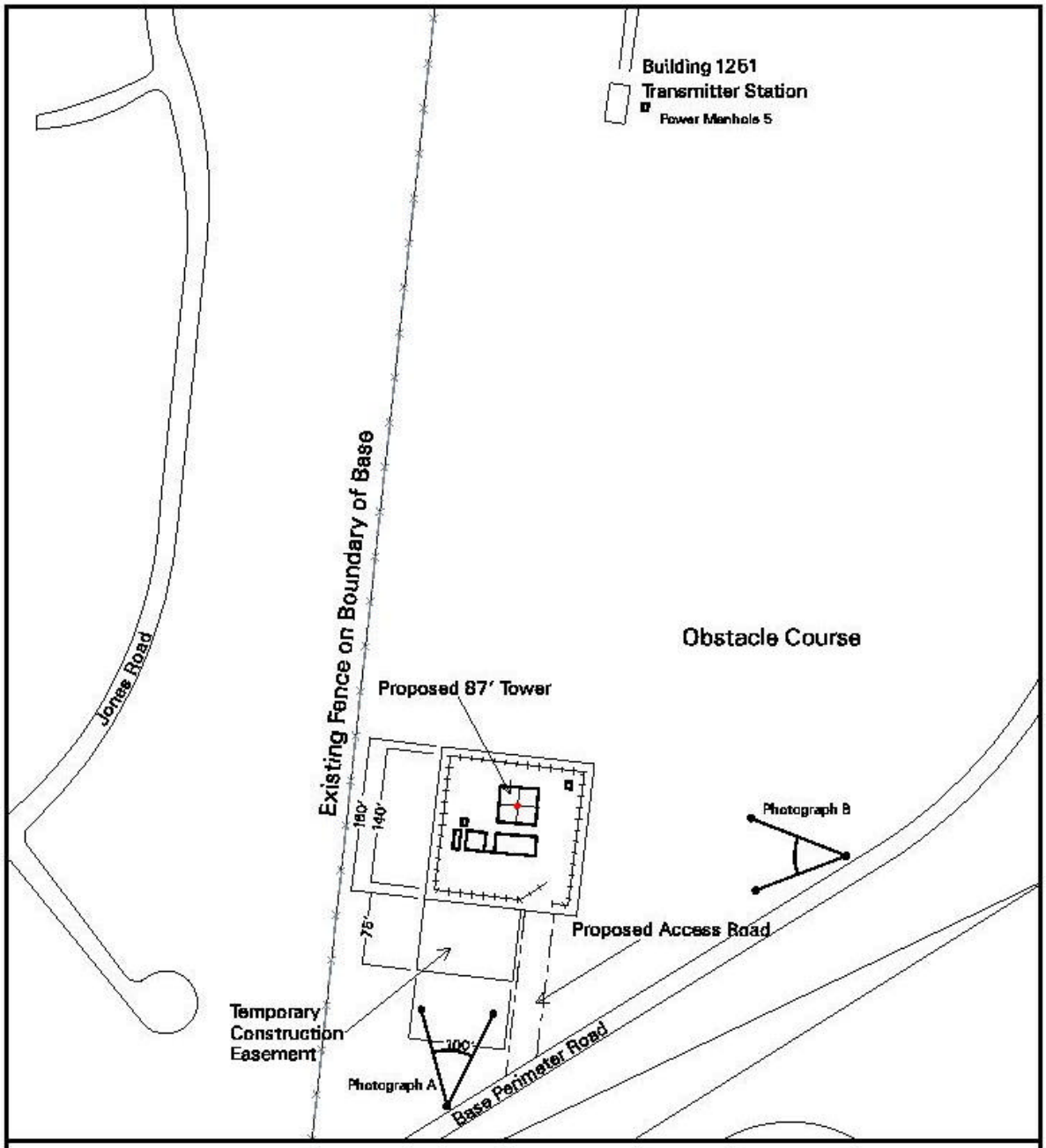


Figure 3.9-1 Location of Photographs at Alternative ASR-11 Site 2.

Photograph A

Photograph B

Figure 3.9-2 Photographs in the Vicinity of Alternative DASR Site 2

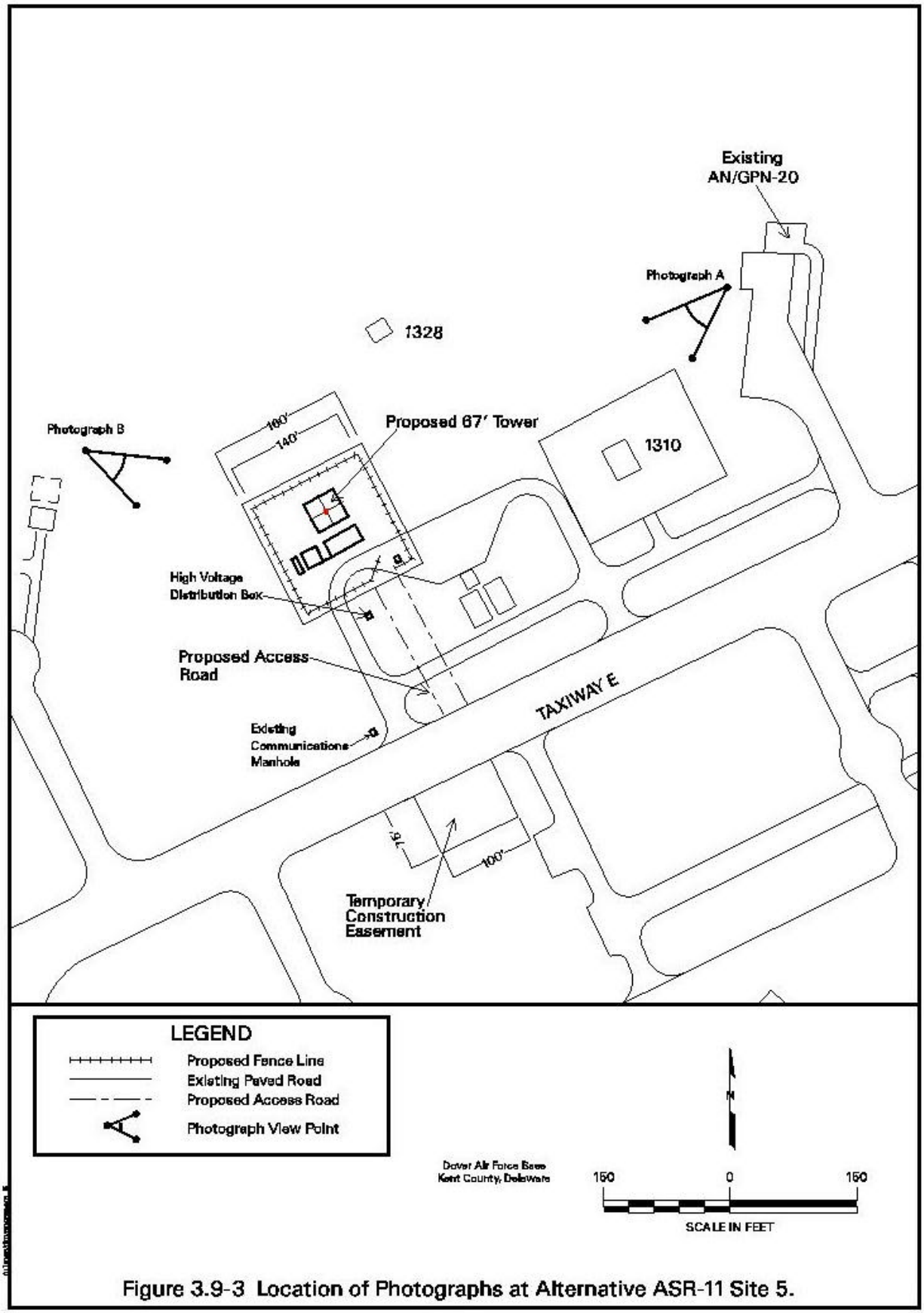


Figure 3.9-3 Location of Photographs at Alternative ASR-11 Site 5.

Photograph A

Photograph B

Figure 3.9-4 Photographs in the Vicinity of Alternative Site 5

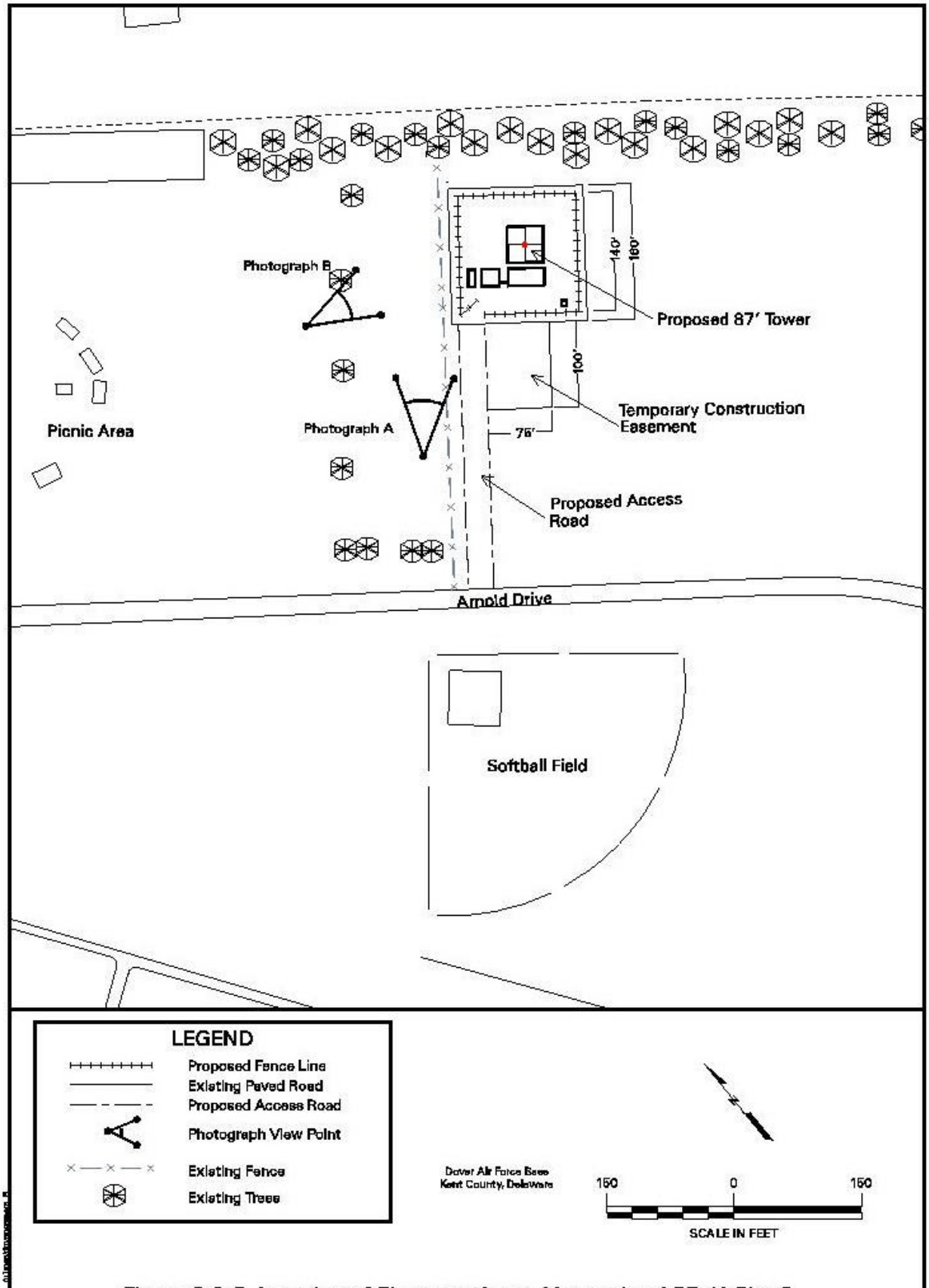


Figure 3.9-5 Location of Photographs at Alternative ASR-11 Site 8.

Photograph A

Photograph B

Figure 3.9-6 Photographs in the Vicinity of Alternative DASR Site 8

Jones Neck Homestead/Farm. The State Historic Preservation Office requested that a more detailed visual impact assessment, including a red balloon test and visual impact simulation be conducted for Site 8. This analysis is presented in Appendix C.

The aesthetic surroundings of the existing **AN/GPN-20** are similar to that of Site 5 which is located approximately 500 feet southwest of AN/GPN-20.

3.9.2 Future Baseline Without the Project

The aesthetic values for alternative ASR-11 Sites 5 and 8, and AN/GPN-20 are not expected to substantially change in the future without the project. There are no proposed projects that would significantly alter the aesthetic resources that currently exist at these sites. Future land use of Site 2 is undetermined, since base personnel have indicated interest in potentially siting a portable radar and an Air National Guard training unit in this area.

3.10 CULTURAL RESOURCES

3.10.1 Existing Conditions

The following section identifies the archaeological and historic resources that are present on Dover AFB. Dover AFB has developed a Cultural Resources Management Plan (CRMP) as part of the Base Comprehensive Plan. The CRMP summarizes the history and prehistory of the base, reviews past historical and archaeological surveys, outlines and assigns responsibilities for the management of cultural resources, and discusses related concerns and standard operating procedures for Dover AFB to help in the preservation of cultural resources on base. The Delaware State Historic Preservation Office (DESHPO) has the authority to approve all development on or near existing cultural resources within its jurisdictional boundaries. The three alternative ASR-11 sites for Dover AFB are located in areas that have not been surveyed. The DESHPO was contacted in September 1998 for information and opinion on existing resources in the vicinity of the alternative DASR sites. As indicated in the previous section on aesthetic resources, the DESHPO did express concern about potential visual impacts on historic resources in the vicinity of the base, and requested that a visual impact assessment be conducted for Site 8 (See Appendix C).

3.10.1.1 Archaeological Sites. There are nine archaeological sites located on Dover AFB that are potentially eligible for inclusion on the NRHP (USAF, 1997b). These sites were found during four different archaeological surveys that were conducted on base from 1965 to 1996. Table 3.10-1 lists the nine sites. The archaeological sites are located in the southern area of the base, in proximity to the St. Jones River and its tributaries (USAF, 1997b). The alternative ASR-11 sites and AN/GPN-20 are not in the immediate vicinity of any of the potentially eligible archaeological sites. Site 8 is approximately 1,600 feet south of a site located by Heite Consulting (Heite Locus 1) and approximately 1,500 feet northwest of the John Wesley Cemetery (7K-D-129).

Table 3.10-1. NRHP Potentially Eligible Archaeological Sites on Dover AFB

Site Number	Site Type
7K-D-2	Archaic/Woodland site with a 19th-century component
7K-D-26	Woodland | basecamp
7K-D-125	19th-Century Farmstead
7K-D-126	19th-Century Farmstead
Locus 3	19th-Century Farmstead
Locus 4	19th-Century Farmstead
Locus 5	19th-Century Farmstead
Locus 1	Possible 18th-Century House Site
7K-D-129	Late 19th, early 20th-century church and cemetery

Source: USAF, 1997b

Approximately 1,050 acres on Dover AFB have not been surveyed. Of this area, 714 acres have a high potential for cultural resources, 266 acres have a moderate potential, and 67 have a low potential (USAF, 1998a). All projects that require ground disturbance in unsurveyed areas must be reviewed by the state historic preservation officer, in accordance with the National Historic Preservation Act. All three alternative sites are in areas that have not been surveyed, and have been given a low potential for cultural resources.

3.10.1.2 Historical Sites and Structures. Building 1301 is one of eight World War II-era facilities remaining at Dover AFB that was determined to be eligible for inclusion in the NRHP (USAF, 1997b). **Site 5** is located approximately 800 feet northwest of Building 1301, and **Site 8** is located approximately 1,600 feet south of Building 1301. Building 1301 was a World War II aircraft hanger and support facility consisting of a hangar, heating plant, and a shop. It was built in 1944 for use by the headquarters and engineering facility of the 4146th Army AFB Unit (1944-1946) as an experimental station. The unit designed and tested air-launched rockets as well as mounted the majority of the rocket launchers on P-47 aircraft inside Building 1301 (USAF, 1997b). After extensive renovation of Building 1301, the hangar is now used as the base museum, housing vintage aircraft. The shop is used for offices and a gift shop, and the power plant is used for storage.

Building 1303 is one of the post-World War II structures on Dover AFB that was determined to be potentially eligible for inclusion on the NRHP under the Cold War historic context (USAF, 1997b). **Site 5** is located approximately 2,200 feet north of Building 1303, and **Site 8** is located approximately 1,180 feet east of Building 1303. Building 1303 was built from 1958-1960 as a 70-man Strategic Air Command (SAC) readiness crew facility with an associated B-52 bomber alert apron. The building has retained its exterior integrity and the interior layout still represents its Cold War alert function. Building 1303 is currently used by the Aero Club, the 436th Civil Engineer Readiness Flight (Disaster Preparedness, Emergency Response), Transient Maintenance, and the Honor Guard.

Three historic resources in the vicinity of Site 8, at the southeast corner of the base, were identified by the DESHPO. These are the Dickinson Plantation, which houses the Dickinson Mansion; the John Wesley Cemetery (noted previously under the discussion of archaeological resources); and a farm/homestead located on St. Jones Neck. The John Wesley Cemetery is located on base property east of the firing range, approximately 1,500 feet southeast of Site 8. The Dickinson Plantation and St. Jones Neck Homestead/farm are located off base property, approximately 5,200 feet and 7,900 feet southeast of Site 8, respectively.

Dover AFB has developed a management plan for the rehabilitation, maintenance, and interpretation of the John Wesley Cemetery. The cemetery is not listed on the National Register. The Dickinson Plantation, located on St. Jones Neck, includes the 1740 brick mansion, reconstructed outbuilding, logged dwelling, and landscaping. The Mansion is listed on the National Historic Register. Few

details are available regarding the St. Jones Neck Homestead/Farm. The Neck, itself, was one of the state's earliest sites of English colonization.

3.10.2 Future Baseline Without the Project

The CRMP would continue to be applied to all future proposed projects. Future goals of the program through 2002 are the following: Acomprehensive archaeological survey of base property to complete the base=s identification requirements under Section 110 of the National Historic Preservation Act; evaluation of the nine potentially eligible archaeological sites; restoration and protection of the John Wesley Cemetery site; training of base personnel; National Register nomination and Historic American Buildings Survey recordation of Building 1303; curation of archaeological artifacts and associated documentation in accordance with 36 CFR 79; and creation of a pamphlet and video describing cultural resources issues for use during Historic Preservation Week (USAF, 1997b).

3.11 POLLUTION PREVENTION AND HAZARDOUS WASTE

3.11.1 Existing Conditions

The following sections describe current conditions and practices on the base with regard to pollution prevention and hazardous waste.

3.11.1.1 Pollution Prevention. No specific pollution prevention measures have been identified at the three alternative ASR-11 sites or the AN/GPN-20; however, base-wide pollution prevention programs are applicable to each of the sites. The environmental programs at Dover AFB include hazardous materials and waste management and minimization of asbestos, polychlorinated biphenyls, lead based paint, scrap metals, petroleum, oils, and lubricants (USAF, 1998a; USAF, 1999c). All pollution prevention efforts are conducted in accordance with applicable federal, state, local, and Air Force regulations, laws, and standards.

Dover AFB has implemented several policies and programs for recovery and reclamation of various waste streams. These programs are documented in the Dover AFB Hazardous Waste and Used Petroleum Management Plan (USAF, 1999c). Uncontaminated jet fuel resulting from aircraft defueling operations may be returned to bulk storage areas; waste oil and contaminated fuels are sent off base to a recycling center; solvents used in parts washers and paint gun washers are reclaimed by solvent recovery operations;

and lead acid batteries are collected and sent off-site for recycling. Household batteries are collected and disposed of as hazardous waste.

3.11.1.2 Hazardous Waste. Hazardous wastes are generated at Dover AFB during daily activities such as aircraft operation and maintenance, including refueling, building and grounds maintenance, and provision of medical services. Hazardous wastes generated include petroleum products, paints, solvents, pesticides and herbicides, and other chemicals and materials used in routine operations at the base.

On-base hazardous waste generation includes four types of sites: generation points, accumulation points (90-day), satellite accumulation points, and spill cleanup equipment/materials storage. As of 1998, there was one 90-day accumulation point located in Building 721, and 34 satellite accumulation points. When the satellite accumulation points container(s) reach a volume of 55 gallons, the waste is transferred to the RCRA permitted Part B Treatment, Storage and Disposal Facility (TSDF) located in Building 1306. Waste from the 90-day accumulation point is moved to the TSDF before reaching the 90-day date identified on the container(s). The waste is held at the TSDF, sampled when necessary, and a waste profile developed for each different waste stream (USAF, 1998a). The waste is then processed through the Defense Reutilization and Marketing Office which schedules contractor pick-up and shipment of the waste to a disposal facility. Dover AFB reports all hazardous waste activities to the state annually (USAF, 1998a).

In March, 1989, Dover AFB was placed on the National Priorities List of the Comprehensive Environmental Response, Compensation, and Liability Act. As of 1998, there were 59 Installation Restoration Program (IRP) sites at Dover AFB. Restoration activities at 26 of these have been completed. All remedial actions for sites requiring cleanup are scheduled to be in place by fiscal year 2005 (USAF, 1998a). The goal of the IRP is to remediate all accident, disposal, or spill sites which may pose a threat to public health, welfare, or the environment. The IRP is administered by the compliance and planning sections of the Base Civil Engineering Environmental Flight.

Site 2 is located approximately 500 feet east of an IRP site, the SD12 drainage ditch, which runs just south of the base perimeter road near the northern boundary of Dover AFB (Figure 3.11-1). From 1951 until 1963, raw wastes from industrial shops activities, including solvents, paint strippers, and plating rinses, were discharged to SD12. From 1963 until 1969, industrial wastewater from the Industrial Waste Basins,

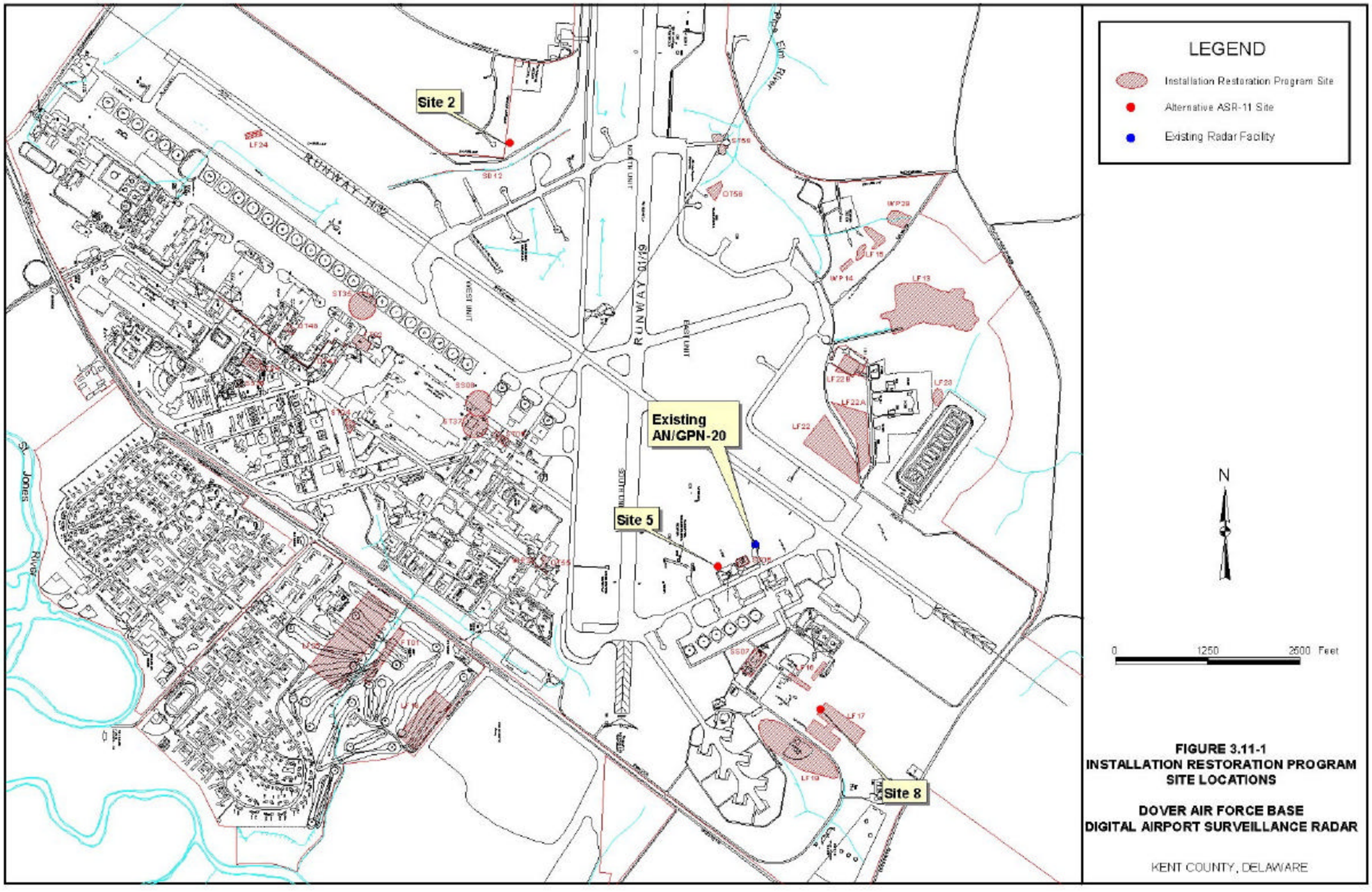


FIGURE 3.11-1
INSTALLATION RESTORATION PROGRAM SITE LOCATIONS

DOVER AIR FORCE BASE
DIGITAL AIRPORT SURVEILLANCE RADAR

KENT COUNTY, DELAWARE

located in the western portion of the base, was discharged to SD12. Approximately 30,000 gallons of mixed organic wastes were discharged to SD12 annually between 1951 and 1969. Wastewater discharges to SD12 were halted in 1969 (USAF, 1997c). SD12 currently receives runoff from the parking apron and runways, as well as the region east of Atlantic Avenue (USAF, 1997c).

SD12 was included in a sampling program conducted from February 1993 to May 1994. Metals detected in the groundwater and surface water were generally within background concentrations, and VOCs were detected at very low levels only in the surface water. Sediment appears to be the principal medium of concern at SD12. However, risks associated with exposure to soil adjacent to SD12 were not quantifiable, because no constituents of concern were identified. Based on the results of this sampling program, risk is below an Excess Lifetime Cancer Risk of 0.0001 and an Hazard Index of 1. Therefore, it has been determined that no further action is required at SD12 (USAF, 1997c).

Site 5 is located approximately 500 feet west of ST06 (Figure 3.11-1). ST06 consists of the area around former Building 1310 and the currently inactive JP-4 fuel distribution lines, and is the site of a documented JP-4 spill/leak of unknown volume and duration that occurred in 1975. In addition, two 25,000 gallon tanks were removed from ST06 in 1991. Fuel-related constituents measured in groundwater samples were limited to relatively minor detections of benzene, ethylbenzene, and xylene. With the exception of methylene chloride, nonfuel-related constituents were detected at very low concentrations or within background conditions and did not exceed maximum concentration levels. A recently completed remedial investigation report concluded that, because no constituents of concern have been detected in down gradient wells, further investigation of ST06 does not appear warranted (USAF, 1997a).

Site 8 is located partially within LF-17, a former landfill where trenches were reportedly filled with refuse to a depth of 32 feet bgs; however, subsequent investigations have indicated that the actual depth of trash is not likely to extend below the water table, which is only 8 to 10 feet below ground surface (USAF, 1997a). Excavations conducted as part of the basewide Remedial Investigation (RI) indicated that the refuse generally consisted of copper pipe, steel signposts, wire cable, oil cans, grease tubes, and automotive parts. Soil samples indicated six volatile organic compounds (VOCs), namely benzene, toluene, ethylbenzene, xylenes, chlorobenzene, and chloroform, were detected at relatively low concentrations (USAF, 2000). VOCs and semivolatile (SVOCs) were detected in groundwater samples collected during the Basewide RI, but at lower concentrations and in a smaller area than previously detected during earlier

(1989) SAIC investigation (USAF, 2000). The primary VOC components detected during the basewide RI were benzene, vinyl chloride, and tetrachloroethene (PCE). Although vinyl chloride was detected in one groundwater sample at 11 ìg/L [which exceeds the maximum contaminant level (MCL) of 2 ìg/L], environmental staff at Dover AFB indicate that the groundwater plume associated with Site 8 has migrated southwest, to the vicinity of LF-19, and is not anticipated to pose a significant concern with regard to the siting of the ASR-11 (USAF, 2000).

LF-19, across the road to the south of Site 8, was used as a construction debris landfill; however, the upgradient LF-17 is considered to be the more likely source of groundwater constituents detected at this site (USAF, 1997a). Site 8 is also located in close proximity to, and downgradient of, LF-16, a former trench-type landfill used for disposal of general refuse. Data collected from LF16 during various investigations indicate that LF-16 is not a source of constituents of concern (USAF, 1997c).

The existing **AN/GPN-20** radar is located approximately 500 feet northeast of Site 5, and therefore is subject to similar conditions related to hazardous waste contamination.

3.11.2 Future Baseline Without the Project

It is expected that management and remediation of hazardous materials and wastes, respectively, will continue. Ongoing pollution prevention measures on the base are expected to reduce the potential for new sources of contamination to arise at any of the sites.

3.12 ELECTROMAGNETIC ENERGY

3.12.1 Existing Conditions

Electrical currents and components generate electrical fields and magnetic fields. These may be stationary or dynamic. Depending on the equipment, electromagnetic radiation that propagates outward may be created. Electromagnetic radiation may be created in a very wide range of frequencies. Absent the propagation of electromagnetic radiation, electrical fields and magnetic fields are localized effects. The electromagnetic environment at a particular location and time is the sum of all the localized electric and magnetic fields plus electromagnetic radiation arriving from both natural and manmade sources. Electric fields, magnetic fields, and electromagnetic radiation are of interest here because of the potential for health

effects from some frequency ranges and the potential for electromagnetic interference on other electronic equipment. Electromagnetic radiation is discussed first in this introduction.

Electromagnetic radiation travels at a uniform speed (3×10^8 m/sec in a vacuum; the speed of light). It is often useful to consider electromagnetic radiation as a wave, and to describe it in terms of frequency (where 1 Hz means 1 cycle per second and 1 kHz means 1000 cycles per second). Some parts of the electromagnetic spectrum are more commonly described in terms of wavelength, which is inversely related to frequency.

The spectrum of electromagnetic radiation includes visible light, which has frequencies on the order of 5×10^{14} Hz (specifically, wavelengths from 400 nanometers (nm) to 760 nm). Electromagnetic radiation with frequencies higher than that of visible light include ultraviolet light, X-rays, and gamma-rays. These types of electromagnetic radiation are described as Ahigh energy≅ and have the potential to Aexcite≅ electrons, to thereby ionize molecules, and to thus affect body chemistry. Especially in high absorbed doses, high frequency electromagnetic radiation can adversely affect health (NSC, 1979).

Electromagnetic radiation with frequencies lower than that of visible light include infrared light and radio waves. Frequencies below 10^{12} Hz (10^6 MHz) are categorized as radio waves. These include frequencies used for AM radio; shortwave, television, and FM broadcast bands; pagers; cellular telephones; mobile radios; radar; and microwave technologies. These frequencies are non-ionizing, and have the following known health effects: (1) effects caused by directly heating body tissues, and (2) electromagnetic interference with electronic medical devices such as pacemakers.

The heating of tissues caused by exposure to electromagnetic radiation at relatively low incident power densities can normally be accommodated. However, in some tissues, heat produced at higher radiation intensities may exceed temperature regulating mechanisms so compensation for heat gain may be inadequate. Thus, exposure at high intensities can cause thermal distress or irreversible thermal damage. Eye tissues are particularly vulnerable (NSC, 1979).

Electromagnetic interference with medical devices has been an issue because medical devices increasingly use sensitive electronics at the same time that radio frequency radiation (RFR) and other electromagnetic sources are proliferating (NASC, 1996). Medical equipment which may be susceptible to interference from

RFR includes cardiac pacemakers, defibrillators, ventilators, apnea monitors, and electric wheelchairs (VTDPS, 1996; IEEE, 1998). Medical device manufacturers are expected to design and test their products to ensure conformance with standards for protection against radio frequency interference (IEEE, 1998). Nevertheless, users of medical devices are generally advised to keep RFR emitters as far away from their devices as is practical (IEEE, 1998).

There is currently considerable interest on the part of some researchers, the news media, and the public regarding the possibility of other health effects from non-ionizing radiation (and/or other electrical or magnetic fields). However, there is no scientific consensus that non-ionizing radiation presents any other health risks (USAF, 1995b) and no consensus about a mechanism by which non-ionizing radiation could have any such effects (i.e. effects other than those associated with heating of tissue and interference with medical devices).

Existing equipment at the AN/GPN-20 radar emits electromagnetic radiation in the radio frequency range. Locations close to and directly in front of the antenna (whether rotating or stationary) are considered unsafe when the radar is operating, on the basis of the potential for heating of body tissues. Similarly, the tower immediately below the antenna is considered unsafe. RFR levels in the immediate vicinity of the existing AN/GPN-20 may be hazardous to humans at close distances, when the radar is in operation. The intensity of the radar energy diminishes with distance, so there would be less tissue heating at greater distances.

Within electronic systems for radar, any high-voltage tubes capable of emitting X-rays are typically shielded with lead, and shielding on other equipment is typically adequate to limit transmitted radiation to acceptable levels. While there are unshielded components present at the AN/GPN-20 site such as incandescent light bulbs, there is no indication or expectation that significant levels of electromagnetic radiation other than RFR is emitted into the environment by the AN/GPN-20 system.

Magnetic fields and electric fields other than electromagnetic radiation are also created by electrical equipment. In everyday situations, high-voltage power lines, televisions, computer monitors, fluorescent lights, light dimmer controls, improperly grounded equipment, and appliances used with non-polarized extension cords create measurable electric fields. Transformers, alternating current (A/C) adapters, motors (e.g., analog clocks and kitchen appliances), power lines, vehicles, and old electric blankets create measurable magnetic fields.

The presence of various electrical components in the AN/GPN-20 radar system inevitably means that there are a variety of magnetic and electrical fields in the vicinity of the AN/GPN-20 equipment. As noted above, there is currently considerable interest on the part of some researchers, the news media, and the public regarding the possibility of health effects from electrical or magnetic fields. However, no scientific consensus exists that electrical or magnetic fields present health risks other than those associated with medical devices. A 1996 National Academy of Science report, *Possible Health Effects of Exposure to Residential Electric and Magnetic Fields*, concluded that:

> *The current body of evidence does not show exposure to these fields presents a human-health hazard. Specifically, no conclusive and consistent evidence shows that exposures to residential electric and magnetic fields produce cancer, adverse neurobehavioral effects, or reproductive and developmental effects.* (NASC, 1996)

Electric and magnetic fields are likely to exist at all three alternative ASR-11 sites due to the ubiquitous presence of electric and magnetic fields in the human environment. There are multiple sources of electromagnetic radiation within Dover AFB as well as external sources. Humans can walk up to the AN/GPN-20 radar when it is in operation. Electromagnetic radiation levels in the immediate vicinity of the existing AN/GPN-20 are not hazardous to humans because the beam is sent out from the radar tower at an elevation above ground level (USAF, 1991b).

3.12.2 Future Baseline Without the Project

Without the project, the future electromagnetic field conditions in the vicinity of the three alternative radar sites and the existing AN/GPN-20 are expected to remain similar to those currently present. There is no planned change in land use in the site locations which would substantially alter the electromagnetic field characteristics in the area. The base has been considering siting a portable radar unit (or an Air National Guard training facility) near Site 2. If the portable radar were installed, localized levels of RFR may increase somewhat in the immediate vicinity of Site 2, but would not be anticipated to pose a hazard to personnel or equipment.

4.0 ENVIRONMENTAL CONSEQUENCES

The No Action alternative would leave existing AN/GPN-20 and air traffic control equipment in place. No new construction, renovation, or operations would be required. Since the no action alternative would involve no alteration to any of the three alternative ASR-11 sites at Dover AFB, this alternative would result in no impact to environmental resources. Thus, the environmental consequences of the No Action alternative would be identical to those identified in Section 3.0, Future Baseline Without the Project. However, selecting the No Action alternative, and thereby having to maintain the existing AN/GPN-20, would require relying on existing radar equipment that is not capable of meeting future user requirements for digital signal data to new digital automation system air traffic controller displays. The existing radar also does not meet user requirements for increased target detection, weather reporting and improved reliability.

The proposed action would involve the construction of a new ASR-11 facility and the removal of the existing AN/GPN-20. Potential impacts associated with the action alternative involve those resulting from construction (short-term) and operation (long-term) of the DASR system. The potential impacts are described in this section for each of the alternative ASR-11 sites (Site 2, Site 5, and Site 8). Potential impacts from removal of the existing AN/GPN-20 are also described. Impacts are presented by environmental parameter. Mitigation measures that may be required to reduce impacts are described in Section 6.0.

4.1 LAND USE

4.1.1 Short-Term Impacts

Short-term impacts associated with construction of the ASR-11 and demolition and removal of the AN/GPN-20 would include temporary disruption of land uses due to elevated noise levels, increased dust, interference with roadway access, and visual effects. The installation of utilities, such as power, telephone, and fiber optic cable to each of the sites could temporarily affect land uses along the proposed alignment routes. While specific alignments will not be defined until final design, it is anticipated that land uses along the alignments would also be affected by elevated noise levels and increased dust associated with open trench excavation.

Site 2 is located in an area that is designated for outdoor recreation. The existing obstacle course would be directly impacted if the radar were constructed at Site 2. However, the obstacle course could be temporarily relocated. The residential area on Janes Road to the west of Site 2 would be affected during construction by elevated noise and visual impacts. The electric power supply is expected to be connected from an existing Power Manhole PM-5 located nearby. The telephone and fiber optic connection will require 950 feet of new construction for the installation of a duct bank from Site 2 to the existing manhole PM-5. Approximately 8,150 feet of fiber optic cable will also be installed in existing duct work from the site to the RAPCON located approximately 5,000 feet south of the site (USAF, 1999d). This connection will not require additional construction. A final alignment for the cable has not been selected, however, minor disruptions to land uses along the route could occur during construction.

Site 5 is located in an area classified as airfield. The site is 500 feet northwest of the existing AN/GPN-20 and 250 feet north of Taxiway E. Construction vehicles would have to cross Taxiway E requiring clearance from Air Traffic Control. Construction activity would be visible from the base museum (Building 1301) which, as previously noted, is on the NRHP. The existing radar is visible from the museum therefore the construction of the new radar would not substantially change the area and would not affect operation at the museum. Mitigation measures to reduce noise levels and to provide visual screening during construction could be implemented to reduce potential adverse effects. Disruptions in traffic and site access to land uses along the proposed route would be expected during construction, although traffic mitigation measures would be implemented to reduce impacts.

Construction of the ASR-11 at **Site 8** would result in some temporary disturbance to adjacent land uses. However, the adjacent playground, family campground/picnic area and softball fields would not be directly impacted, and thus, no significant impacts are anticipated. Users of the nearby recreational areas would experience noise, dust, and visual impacts during construction work hours, however, access to the facilities would remain. Training activities at the nearby firing range, however, may prohibit access to the site during certain parts of the day; thus, coordination during construction would be required to ensure the safety of workers. Extending the electric power supply from Pole 235 at Building 1324 would require approximately 900 feet of new construction. Installation of the telephone and fiber optic communication would require approximately 170 feet of new construction to connect to an existing underground communications line east of the site (USAF, 1999a). The fiber optic cable will continue approximately

9,750 feet via an existing communications line to the RAPCON located 4,700 feet northwest of the site. A final alignment for the cable has not been selected, however, minor disruptions to land uses along the route could occur during construction.

Impacts to surrounding land uses related to dismantling and removal of the **AN/GPN-20** would be minor, similar to those stated above for the construction of the ASR-11 at Site 5.

4.1.2 Long-Term Impacts

Land use would not be substantially affected by the operation of the DASR at **Site 2**. The obstacle course could be relocated to an area adjacent to the ASR-11 with no concern of electromagnetic radiation. The residential area to the north would not experience an increase in noise from the radar. There would be a change in views of the site from the residential area; however, existing trees would help to minimize the impact (See Section 3.9).

Operation of the ASR-11 at **Site 5** would have no long-term impacts to land use. The operation of the ASR-11 would be consistent with other military operations in the area which currently include operation of the existing AN/GPN-20. The base museum (Building 1301) is not expected to be affected by the ASR-11.

The playground and camp/picnic area near **Site 8** would be able to continue as recreational land uses. The ASR-11 would be visible from these recreational facilities and would alter the aesthetic character of the area (See Section 3.9), but once operational, should have minimal impact on users of these facilities because the facility would not generate adverse noise, air quality, or traffic impacts. During training activities at the nearby firing range, access for maintenance or other purposes to the site may be prohibited; therefore, coordination would be required with Weapons Safety for access.

There are no planned changes in land use in the site locations which would substantially alter the electromagnetic field characteristics in the area although the Base is considering locating a portable radar unit in the vicinity of Site 2. No impacts to nearby receptors are anticipated at any of the three alternative sites due to the presence of the ASR-11. At all locations near the radar, the ASR-11 signal will comply

with guideline levels for exposure. Therefore, no land use impacts are anticipated due to electromagnetic radiation impacts of the ASR-11.

Removal of the **AN/GPN-20** would have no adverse land use effects. The area has no known future use other than as airfield.

4.2 SOCIOECONOMICS

4.2.1 Short-Term Impacts

Construction of the ASR-11 at any of the three alternative sites would require similar work efforts, and would, therefore, have similar effects on socioeconomic conditions on the base. Construction at **Site 2, 5,** or **8** would not adversely impact the socioeconomic conditions at Dover AFB. There would be a slight short-term increase in revenue generated in the surrounding area due to construction employees utilizing local businesses for supplies and personal use. During the construction period, the work crew would consist of approximately 10 persons.

Upon the successful completion of the construction of the ASR-11, the existing **AN/GPN-20** radar would be dismantled. No effects on socioeconomic conditions are anticipated as a result of this activity.

4.2.2 Long-Term Impacts

The Executive Order 12898 dealing with environmental justice requires federal agencies to identify and address disproportionately high and adverse human health and environmental effects of federal programs, policies, and activities on minority and low-income populations. **Site 2** is located adjacent to an off-base, private community composed of approximately 30 single-family homes. According to 1990 census data, the income of 40 percent of the population within this census tract is below the federal poverty level (USAF, 1999a). Neither **Site 5** nor **Site 8** is located adjacent to residential neighborhoods. While a low income population group does reside adjacent to alternative Site 2, no adverse human health and environmental impacts are anticipated to occur as a result of operation of the ASR-11. Therefore, the DASR program at Dover AFB is consistent with Executive Order #12898.

In the absence of other independent activities at Dover AFB, socioeconomic conditions would return to existing conditions once the DASR construction was completed. The new radar facility would be unmanned, and would, therefore, have no long-term effect on socioeconomic conditions.

4.3 UTILITIES AND TRANSPORTATION

4.3.1 Short-Term Impacts

As described below, it is not anticipated that construction of the ASR-11 at any of the alternative sites or removal of the existing AN/GPN-20 would result in adverse impacts to existing utilities or transportation.

4.3.1.1 Water Supply. A temporary increase in water demand would occur during construction. A water source would be supplied on site by mobile water tanks. It is not anticipated that the water demand for the construction of the ASR-11 would adversely impact the water supply at Dover AFB due to the small number of construction workers and short construction period.

4.3.1.2 Wastewater Treatment. There would be an insignificant short-term increase in demand for sewage treatment during construction. Portable wastewater units would be on site and the septage would be transported to the treatment facility.

4.3.1.3 Solid Waste. During the dismantling of the existing AN/GPN-20 radar, there would be a need to remove solid waste material that may not be able to be re-used in the future. All solid waste would be handled in accordance with standard base procedures. Any hazardous materials produced would be disposed of following Dover AFB policies and protocols and relevant state regulations (see also Section 4.11 on hazardous materials).

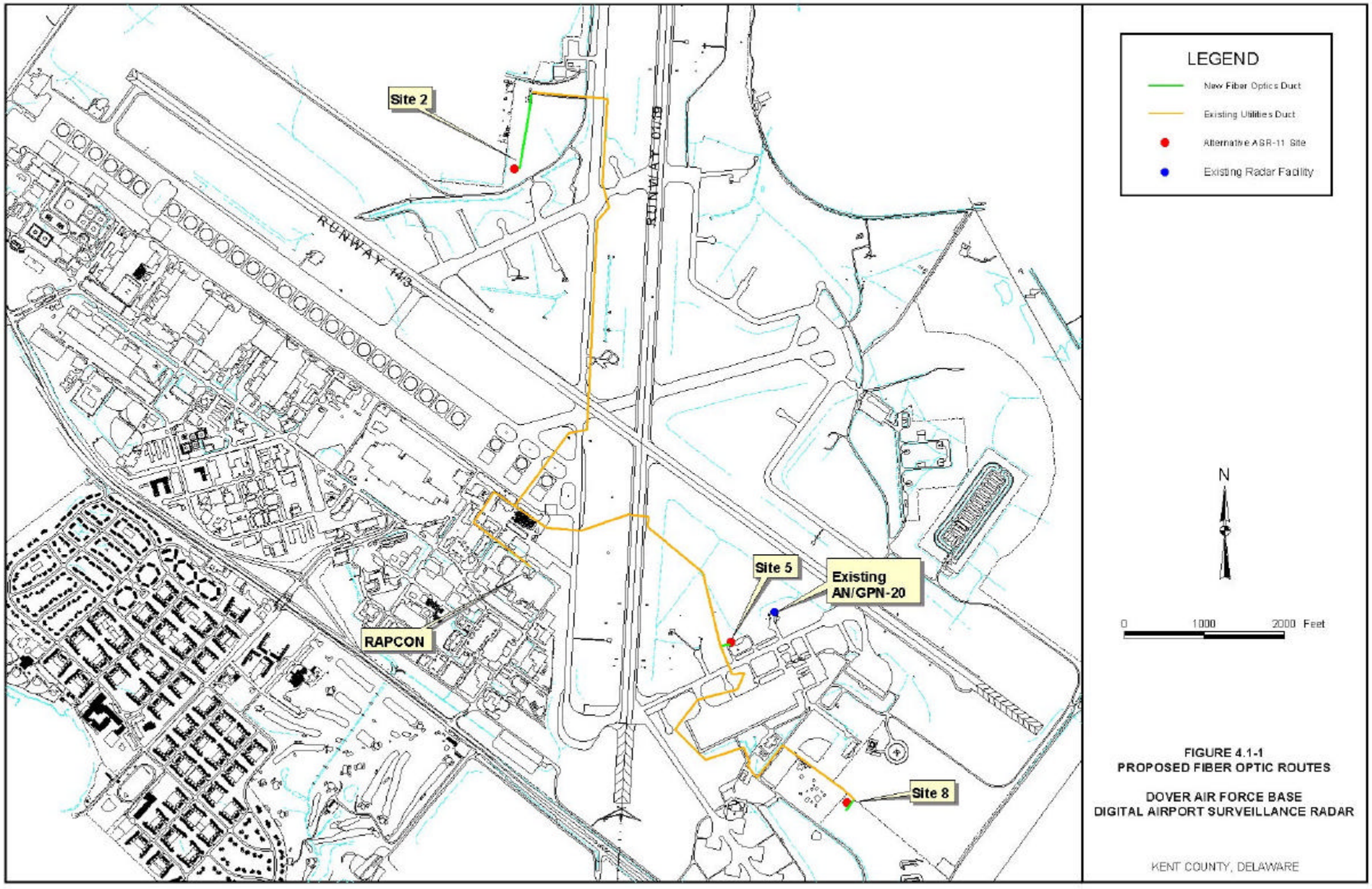
4.3.1.4 Electricity. Sufficient electrical power is available to each of the alternative ASR-11 sites. Specific routes will be determined when a site is selected and final design plans are completed. Power lines could be routed to **Site 2** via an underground conduit from Power Manhole PM-5 located 950 feet north of the site. **Site 5** would receive electricity from a high-voltage distribution box 100 feet south of the site via underground lines. **Site 8** would be supplied with electricity from distribution lines at Pole 235 at Building 1324, 900 feet to the northwest through an underground conduit. The construction of the conduits could impact land uses in the immediate vicinity of the trench excavation; however, electrical power in the area of the alternative ASR-11 sites would not be impacted.

4.3.1.5 Communications. Conduits for telephone line would be installed via open trench excavation in order to provide a communication link to the ASR-11 site. Surface disruption resulting from the connections could be up to approximately 950 feet for **Site 2**, 200 feet for **Site 5**, and 170 feet for **Site 8** (Figure 4.1-1). This could result in temporary impacts to the immediate land use during the open trench excavation; however, the installation of the telephone line would not impact telephone service in the area of the alternative ASR-11 sites.

The fiber optic cable will be partly installed within the same conduit proposed for the telephone lines. Simultaneous excavation for both the telephone line and the fiber optic cable will minimize land impacts. **Site 2** will require approximately 950 feet of new construction to the existing communication line. The fiber optic cable will then continue through an existing duct bank to connect to the RAPCON approximately 5,000 feet south of the site. The total length of new fiber optic cable will be 9,100 feet. **Site 5** will require approximately 200 feet of new construction to the existing communication line. The fiber optic cable will then continue through an existing duct bank to connect to the RAPCON located approximately 2,750 feet west of the site. The total length of new fiber optic cable will be 6,130 feet. **Site 8** will require approximately 170 feet of new construction to the existing communication line. The fiber optic cable will then continue through an existing communications line to connect to the RAPCON located approximately 4,700 feet northwest of the site. The total length of new fiber optic cable will be 10,000 feet.

4.3.1.6 Natural Gas. Natural gas is not required for the proposed ASR-11, therefore there would be no impact to existing natural gas conditions on Dover AFB.

4.3.1.7 Transportation. Impacts on transportation within Dover AFB would be minimal. The small size of the project would not produce a volume of construction related traffic that would impact existing conditions. Personal vehicles and small trucks of the contractor and subcontractors would be on site or at an area designated by the Air Force. There would be a period of approximately 10 hours when cement trucks would enter the base for the foundation placement. The foundation cement must be placed continuously, thus necessitating the 10 hour period. It is not expected that cement trucks and other heavy construction vehicles necessary for construction would have an impact on base roads. Construction related activities would not adversely impact existing traffic conditions.


LEGEND
New Fiber Optics Duct
Existing Utilities Duct
Alternative ASR-11 Site
Existing Radar Facility
N
0
1000
2000 Feet
Site 2
RUNWAY 14/32
RUNWAY 01/19
Site 5
Existing
AN/GPN-20
RAPCON
Site 8
FIGURE 4.1-1
PROPOSED FIBER OPTIC ROUTES
DOVER AIR FORCE BASE
DIGITAL AIRPORT SURVEILLANCE RADAR
KENT COUNTY, DELAWARE

4.3.2 Long-Term Impacts

It is not anticipated that future utility and transportation conditions would be affected as a result of operation of the ASR-11. The addition of electrical power, telephone lines, and fiber optic cable at any of the alternative ASR-11 sites would not have an effect on the utilities in the area. The operation of the proposed ASR-11 would not require water resources, wastewater treatment, collection of solid waste, or natural gas resources, therefore, no impacts to those utilities would occur. No long-term impacts on traffic are anticipated.

4.4 NOISE

4.4.1 Short-Term Impacts

Noise impacts during construction are expected to be similar at all three sites. Construction of the radar tower and supporting infrastructure, including connections to power and telephone, and installation of the fiber optic cable, would result in elevated noise levels as grading and minor excavation occur, and as construction of the tower proceeds.

Typical construction equipment noise levels may be reduced by using well-maintained equipment and by installing mufflers and engine jackets (Table 4.4-1). Construction of the tower and supporting infrastructure is anticipated to take approximately three weeks, and therefore, any elevated noise levels would be of very short-term duration. As indicated in the baseline conditions section of this EA, both **Site 2** and **Site 8** are located near sensitive receptors. Site 2 is located approximately 400 feet from an off-base residential development composed of approximately 30 single-family homes, and Site 8 is located approximately 275 feet from a playground (USAF, 1999d). In both cases, increased noise levels would be mitigated and of such a short-term nature that substantial impacts to these receptors are not anticipated. Of the three sites, **Site 5** is closest to an operating building on the base. Intermittent noise disruptions could occur at this facility (Building 1320) during construction at this site; however, substantial impacts are not anticipated.

Dismantling and removal of the existing **AN/GPN-20** would result in temporary elevated noise levels; however, these are anticipated to be of short duration, and at a distance from any sensitive noise receptors.

Table 4.4-1. Construction Equipment Noise Levels in dBA (L_{eq}) at 50 Feet

Equipment	Field Measurements	Well-Maintained Equipment with Mufflers and Engine Jackets	Best Technology (Specialized Mufflers and Shields)
Air Compressor	81	71	65
Back Hoe	85	80	76
Concrete Mixer	85	83	75
Concrete Pump	82	80	75
Concrete Vibrator	76	70	- -
Crane, Derrick	88	80	66
Crane, Mobile	83	80	76
Dozer	87	83	76
Generator	78	71	78
Grader	85	80	65
Jack Hammer	88	80	76
Loader	84	80	75
Paver	89	80	76
Pile Driver	101	90	76
Pneumatic Tool	85	75	80
Pump	76	71	65
Rock Drill	98	90	65
Roller	80	75	80
Saw	78	70	70
Scraper	88	83	65
Shovel	82	80	78
Truck	88	83	76
Truck Alarms	94	89	75

Sources: Bolt, Beranek, and Newman, 1974
(*Regulation of Construction Activity Noise*. BBN Report No. 2887. November 1974)

4.4.2 Long-Term Impacts

Operation of the ASR-11 would not increase the number of flights, affect any approach or departure tracks, change the use of any runways, or affect the mix of aircraft at the base. Thus, it is not anticipated that there would be any long-term noise impacts as a result of operation of the ASR-11 radar. Noise levels generated by the ASR-11 would be maintained at a level consistent with current OSHA regulations as specified in CFR Title 29, Part 1910. Noise from ASR-11 equipment located in operational areas would be designated not to exceed 55 dBA at any time. Noise from ASR-11 equipment located in general work areas should not exceed 65 dBA, including periods when the cabinet doors are open. The antenna pedestal with its drives, mounted on its tower, will be designed not to produce noise levels in excess of 55 dBA outdoors on the ground at a distance of 100 feet from the tower.

4.5 AIR QUALITY

4.5.1 Short-Term Impacts

The short-term air quality impacts of constructing a ASR-11 would be similar at all of the three alternative sites. ASR-11 site clearing and construction vehicle traffic would generate fugitive dust during the construction period. Construction of an ASR-11 at any of the sites would require disturbing approximately 0.6 acres. Since the area that would be disturbed at each of the sites is similar, the amount of dust generated during construction is not expected to vary substantially among the sites. No new roads would be needed with the exception of gravel access driveways.

Distances for new electrical connections between the alternatives sites and existing utility sources in the vicinity of the sites will be determined when the site design is completed, although preliminary estimates indicate that between 100 and 950 feet of trench would be required.

Installation of the communications (fiber optic and telephone) connections would require the construction of approximately 950 feet of conduit from **Site 2**; 200 feet of conduit from **Site 5**; and 170 feet of new conduit from **Site 8**. Dust would be minimized by applying water as needed during construction. Consequently, no adverse short-term dust impacts are anticipated at any of the sites.

As described in the Programmatic EA for the NAS program (USAF, 1995b), construction vehicles and equipment would produce emissions that could temporarily affect air quality. However, because the

number of vehicles required is relatively few and the construction duration is limited, emissions are not anticipated to cause an exceedance of either National or Delaware Ambient Air Quality Standards in the vicinity of the alternative ASR-11 sites.

Similar to the installation of the new ASR-11, dismantling of the existing **AN/GPN-20** radar would generate some fugitive dust and some vehicle and equipment emissions. The nominal emissions and dust generated during the AN/GPN-20 dismantling are not anticipated to cause an exceedance of either the state or federal AAQS.

4.5.2 Long-Term Impacts

Operation of the DASR at any of the three alternative sites would produce identical emissions, which are not anticipated to have any adverse impact on air quality. Sources of emission during the operation of the DASR site would include the operation of the emergency diesel generator at the ASR-11 site and evaporative loss of fuel from the above-ground storage tank on the ASR-11 site. As described in the Programmatic EA for the NAS program (USAF, 1995b), the emergency generator is anticipated to be operated approximately once per week for testing and during occasional power outages. The emissions anticipated to be produced by the emergency generator would be far below the 100 tons per year threshold which triggers review under the Prevention of Significant Deterioration regulations, and are therefore expected to have no adverse impact on air quality (USAF, 1995b). The evaporative loss from the AST is also expected to be minimal, and to have no adverse impact on air quality. The Programmatic EA also stated that maintenance traffic on unpaved access roads would generate fugitive dust during operation of the ASR-11 facility. However, all of the potential ASR-11 sites at Dover AFB would be accessed by either a new paved road or gravel roads. Consequently, minimal fugitive dust should be generated during operation of the ASR-11 facility at Dover AFB.

4.6 GEOLOGY AND SOILS

4.6.1 Short-Term Impacts

The construction of the ASR-11 would have similar effects on the soil at each of the alternative ASR-11 sites. Excavations for the footings of the radar tower typically do not exceed seven feet in depth. If soil conditions prove to be poor, as may be the case at **Site 2** or **Site 8**, the excavation depth could be increased in order to replace the poor soil with fill that is more stable than the existing soil. Due to the presence of

potentially unconsolidated soil and refuse material at Site 8, soil borings would be conducted as part of site design, to determine the extent/presence of unconsolidated soil and/or refuse material.

Excavation for a utility trench is typically four feet deep, and may be 10 feet wide. Problems associated with caving may occur during deeper excavations. If the banks of the excavated areas are unstable, they could be stabilized with sheeting or other supports, as appropriate.

The dismantling of the **AN/GPN-20** would not require any ground disturbance. The existing radar system would be dismantled to ground level, leaving the foundations in place. All hazardous material encountered would be properly disposed. Therefore, there would be no impact to the soils or geology.

4.6.2 Long-Term Impacts

There would be no long-term impacts to the existing soils or geology if the ASR-11 were constructed at any of the alternative ASR-11 sites.

4.7 SURFACE WATER AND GROUNDWATER

4.7.1 Short-Term Impacts

It is not anticipated that construction of the ASR-11 at any of the alternative sites would have adverse impacts on surface water. However, there is the potential for stormwater runoff conditions to change at the selected site. During the construction period, vegetation, which consists of grass at each site, would be removed and excavations for foundations would be placed. The removal of vegetation could temporarily increase the stormwater runoff.

The installation of the fiber optic conduit along base roads for each alternative DASR site could temporarily alter stormwater conditions. Dover AFB has a Stormwater Pollution Prevention Plan that will be used for guidance on sediment and erosion control during construction of the ASR-11 and associated facilities in order to prevent impacts to future surface water conditions.

The excavations for the tower footings, approximately seven feet deep, are not expected to penetrate the water table at **Sites 5** and **8.** Groundwater below Site 8 may be contaminated with VOCs and SVOCs (See Section 3.11.1.2). If groundwater is encountered during excavation at Site 8, monitoring and potentially treatment of the water may be required. Seasonally high groundwater has been reported at **Site 2** due to higher than average rainfall and the nearby presence of a drainage ditch. The possibility of seasonally high groundwater and the presence of hydric soils (Section 3.6.1.2.), indicate that there is the potential that

construction of the proposed project would temporarily intercept the groundwater in the vicinity of Site 2. Measures would need to be taken during construction to handle and discharge groundwater appropriately.

The dismantling of the **AN/GPN-20** would not require ground disturbance.

4.7.2 Long-Term Impacts

The fenced-in area for all alternative ASR-11 sites would be approximately one-half acre or less and would be constructed of crushed stone over filter fabric. The porous materials would allow the infiltration of stormwater into the soils and reduce the potential for stormwater runoff. The radar tower footings and foundations for related facilities would be constructed of cement. The specific dimensions of impervious area will be determined when the final site design is completed. A short access road, approximately 16 feet wide, to each of the sites will be required (USAF, 1999a). The access road would be constructed of six inches of crushed stone over filter fabric, and would not be expected to have an impact on surface water or groundwater. **Site 2** may require the construction of a paved access road, due to possible presence of unstable soils, adding an impervious surface of approximately 2,400 square feet. If the access road does need to be paved, final design would include measures to handle drainage from the roadway.

Removal of the **AN/GPN-20** is not expected to have an impact on storm water runoff conditions.

4.8 BIOLOGICAL RESOURCES

4.8.1 Short-Term Impacts

The following describes potential short- and long-term effects of the installation of a DASR system on biological resources. The biological resources addressed in this section consist of vegetation, wetlands, wildlife, and threatened and endangered species.

4.8.1.1 Vegetation. Sites 2, 5 and **8** are entirely mowed grass. The sites would be cleared of vegetation during construction. Due to the abundance of this vegetation cover type on base and relatively small area that would be cleared for the ASR-11, impacts would be considered minor.

4.8.1.2 Wetlands. None of the alternative ASR-11 sites are located in areas that were identified as wetland resource areas in previously conducted delineations. The onsite investigation performed between June 24 and July 23, 1998 confirmed that neither the radar nor the utility connections would be within a delineated wetland. **Site 2** is located approximately 500 feet from a drainage ditch. The NWI maps depict

this area as an intermittently flowing stream. However, no wetland impacts are anticipated at any of the alternative sites or the existing **AN/GPN-20**. Based on a review of preliminary site layouts and communications link routes, it does not appear that routes from the sites to the RAPCON for the fiber optic cable cross any wetlands.

4.8.1.3 Wildlife. No significant short-term wildlife impacts are anticipated at any of the proposed ASR-11 locations or the AN/GPN-20. Construction of the ASR-11 would require disturbing approximately 0.45 acre of mowed grass at **Sites 2, 5**, and **8**. Thus, construction is anticipated to have minimal adverse impact on wildlife habitat. In addition, the noise generated during construction of the ASR-11 and dismantling of the **AN/GPN-20** is expected to have minimal impact on wildlife in the area.

4.8.1.4 Threatened and Endangered Species. No threatened or endangered species are known to be present in the vicinity of the proposed ASR-11 sites. Therefore, no impacts to threatened or endangered species are anticipated during construction at any of the alternative sites, or the AN/GPN-20.

4.8.2 Long-Term Impacts

4.8.2.1 Vegetation. As described in the baseline conditions (Section 3.8) , each of the proposed sites and the AN/GPN-20 are located within previously disturbed areas. The proposed ASR-11 facility would replace a 0.45 acre parcel of grassy surface with approximately 0.45 acre of crushed stone/gravel and impervious surfaces. Due to the disturbed nature of the three alternative sites and prevalence of grassland on base, the small loss of vegetation is not considered to be a significant adverse impact.

The dismantling of the AN/GPN-20 would have no long-term impacts to vegetation.

4.8.2.2 Wetlands. Adverse long-term impacts to wetland resources are not anticipated for the construction of an ASR-11 at any of the three potential sites. The site of the existing AN/GPN-20 also does not contain any wetland resource areas. Thus, no impacts to wetlands would occur as a result of its removal.

4.8.2.3 Wildlife. No significant adverse long-term impacts to wildlife are anticipated from the presence and operation of an ASR-11 at any of the alternative sites or at the site of the dismantled AN/GPN-20. The selected ASR-11 site would be surrounded with a chain-link fence, which would act as a barrier to larger mammals, precluding them from the site. The ASR-11 tower could theoretically pose an obstacle to birds

flying through the area of the site. However, as discussed in the Programmatic EA for the NAS program (USAF, 1995b), the relatively low height of the radar antennas is not anticipated to pose a substantial threat to birds flying through the area.

4.8.2.4 Threatened and Endangered Species. Operation of the ASR-11 at any of the alternative sites or the dismantling of the AN/GPN-20 is not anticipated to adversely impact threatened or endangered species since no such species are known to exist at the sites.

4.9 AESTHETIC RESOURCES

4.9.1 Short-Term Impacts

The construction of the ASR-11 would have an effect on aesthetic conditions at each of the alternative sites proposed for Dover AFB. **Site 2** is approximately 400 feet from an off-base, private community composed of approximately 30 single-family homes (USAF, 1999a). Visual impacts associated with the development of the ASR-11 at this site would be moderate. However, the impact would be somewhat mitigated by an existing line of trees and shrubs. The land surrounding **Site 5** supports older aircraft aprons and hangers, including Building 1301, a National Register of Historic Places site which houses the Air Museum. The hanger is approximately 800 feet from Site 5 (USAF, 1999a). The existing radar is visible from the museum, therefore the construction of the new radar would not substantially change aesthetic conditions at the museum. The impact at this site is expected to be minor, since base visitors and personnel are accustomed to aircraft related sites and activities. Construction activity associated with the removal of the **AN/GPN-20** would not adversely effect the existing aesthetic resources at the site. Overall, installation of one radar system coupled with removal of one radar system would result in no net change in aesthetic resources. **Site 8** is near a base playground, recreation fields, and family camping area. Site 8 is also located near several historic resources in the southeastern corner of the Base. While construction of the radar at this site would be noticeable, the activity would be consistent with military base function.

4.9.2 Long-Term Impacts

As noted above, Site 2 is located in close proximity to a private residential neighborhood, and aesthetic conditions would be altered by the presence of the ASR-11. The impact would be mitigated by existing trees and shrubs. The Delaware State Historic Preservation Office (DESHPO) has expressed concern regarding long-term visual impacts at Sites 5 and 8. Although the existing radar tower is currently in direct view of Building 1301, DESHPO has expressed concern regarding potential visual impact on the hanger

from the proposed ASR-11 at **Site 5**. The existing radar would be removed once the new ASR-11 radar is constructed and operational, therefore, there would be no substantial change in aesthetic resources at Site 5.

Site 8 is located near a playground, ballfields, and camping area. The site is also near three historic sites: the Dickinson Mansion which is listed on the National Register, and is 4,400 feet south of Site 8; the John Wesley Cemetery which is eligible to be listed on the National Register, and is approximately 1,150 feet east of Site 8; and St. Jones Neck Homestead/Farm, approximately 7,500 feet southeast of Site 8. At the request of the DESHPO, a visual impact analysis was conducted for this site (See Appendix C). The results of the analysis indicate that the proposed ASR-11 would be visible from the southwest corner of the John Wesley Cemetery. While the radar would be visible from the cemetery as well as the nearby recreational facilities, the view would be consistent with other views on the base where military activities and facilities are present. The result of the visual impact analysis indicated that no adverse visual impact would be anticipated at either the Dickinson Plantation or the St. Jones Neck Homestead/Farm if the ASR-11 was located at Site 8.

4.10 CULTURAL RESOURCES

4.10.1 Short-Term Impacts

The three alternative ASR-11 sites for Dover AFB are located in areas that have not been surveyed for archaeological resources. The Delaware State Historic Preservation Office (DESHPO) was contacted in September 1998 for information and opinion on existing resources in the vicinity of the alternative DASR sites and will be contacted upon final site selection.

There are no prehistoric or historic resources in the vicinity of alternative **Site 2**. As noted previously, the World War II aircraft hanger Building 1301 is a National Register of Historic Places site, which currently houses the Air Museum. The hanger is approximately 800 feet southeast of **Site 5**. Construction at Site 5 would be visible from Building 1301; however, there would be no direct impact on the building. The existing radar is visible from the Air Museum, therefore the new radar would not contribute additional aesthetic impacts to the museum (since the existing radar will be removed). **Site 8** is near a base playground, recreation fields, and family camping area. As noted in the aesthetic resources section, the Dickinson Mansion, listed on the National Register, the John Wesley Cemetery, which is eligible to be listed on the National Register, and the St. Jones Neck Homestead/Farm are located in the vicinity of Site 8. The

construction of the ASR-11 facility would not have a direct impact on cultural resources; the associated construction activities would be consistent with other ongoing military activities at Dover AFB.

The cultural surroundings of the existing **AN/GPN-20** are similar to that of Site 5 which is located approximately 500 feet southwest of AN/GPN-20. Construction associated with dismantling the AN/GPN-20 is not anticipated to impact cultural resources.

4.10.2 Long-Term Impacts

There would be no major cultural or historic resource impacts related to the operation of the ASR-11 at any of the alternative sites. While the radar would be visible from the southwest corner of the John Wesley Cemetery, the view would be consistent with the military function and aesthetic conditions of the base. Operation of the ASR-11 is not expected to substantially alter the setting of Building 1301, and would not affect the building itself in any manner.

4.11 POLLUTION PREVENTION AND HAZARDOUS WASTE

4.11.1 Short-Term Impacts

4.11.1.1 Pollution Prevention. The construction phase of the DASR system project would comply with all applicable Dover AFB policies and guidelines for pollution prevention. In addition, a pollution prevention plan has been developed for the NAS program. This plan prohibits the use of all Class I ozone depleting chemicals and directs the contractor to minimize the use of Class II ozone depleting chemical and toxic substances. Consequently, hazardous waste generation is anticipated to be reduced to the maximum extent possible during construction of the ASR-11 and supporting facilities, and the dismantling of the existing AN/GPN-20. Similar pollution prevention measures would be implemented during construction regardless of the alternative site at which the radar is constructed.

4.11.1.2 Hazardous Waste. Regardless of which site is selected, some hazardous materials and waste would likely be used and generated during construction, including: equipment fuel, engine oil, hydraulic oil, grease, and other equipment operation and maintenance material. Refueling of equipment may also take place at the site selected for construction. Any hazardous materials used during construction would be used, stored, transported, and disposed in accordance with base, military, state, and federal regulations.

It is anticipated that no contaminated soils would be encountered at **Site 2** or **Site 5**; however, construction at **Site 8** may encounter buried refuse, such as copper pipes, steel signposts, wire cable, oil cans, grease tubes, or automotive parts, associated with the former use of the site as a landfill (LF-17). The construction of the ASR-11 would require excavation to an approximate depth of seven feet to facilitate the antenna foundation installation. Due to the relatively shallow depth of installation, groundwater is not expected to be encountered at Site 5 or Site 8 as discussed in Section 5.7, Surface Water and Groundwater. However, there is the potential to penetrate the water table at Site 2 due to higher groundwater, but there has been no indication of contaminated groundwater in the vicinity of Site 2. Consequently, it is not expected that any contaminated groundwater would be encountered at any of the alternative sites. The utility trenches would be relatively shallow (four feet) and would, therefore, not encounter groundwater.

The existing **AN/GPN-20** tower is not painted with lead paint, however, the shelter associated with the tower is. The AN/GPN-20 will be dismantled and transported off-site. The contractor will be required to separately and properly package, mark, and dispose of hazardous materials encountered during the dismantling of the AN/GPN-20 and facilities equipment. Consequently, substantial amounts of lead paint should not be left on site as a result of the decommissioning of the radar. However, small pieces of lead paint may chip off the AN/GPN-20 radar during the dismantling process. As part of the dismantling, the area will be surveyed prior to final site decommissioning, and lead paint chips will be collected and disposed of in accordance with applicable Dover AFB policies and procedures.

4.11.2 Long-Term Impacts

4.11.2.1 Pollution Prevention. As indicated above, a pollution prevention plan has been developed for the NAS program. The plan prohibits the use of all Class I ozone depleting chemicals, and directs the contractor to minimize the use of Class II ozone depleting chemicals and toxic substances. In addition, operation of the ASR-11 facility would comply with all applicable Dover AFB policies and guidelines for pollution prevention. Consequently, hazardous waste generation is anticipated to be reduced to the maximum extent possible during the operation of the ASR-11 facility.

4.11.2.2 Hazardous Waste. Operation of the radar facility at any of the three alternative ASR-11 sites would include the storage of diesel fuel, used for emergency generation, in a 1,000 gallon AST. The tank would comply with all federal, state, and base spill control requirements, including a leak detection system, overfill alarm, and double-wall and/or secondary containment (USAF, 1999a). In addition, hazardous

materials and waste would likely be used and generated during radar operation, including equipment fuel, engine oil, hydraulic oil, grease, and other equipment operation and maintenance material. All hazardous waste would be used and disposed of in accordance with applicable regulations and base policies. Consequently, it is not anticipated that any soil or groundwater contamination would occur as a result of the radar operation.

The removal of the AN/GPN-20 would reduce the potential for generation of any hazardous waste at this site.

4.12 ELECTROMAGNETIC ENERGY

4.12.1 Short-Term Impacts

Construction at any of the DASR alternative sites on Dover AFB would not generate electromagnetic radiation at levels that would be harmful to human health. Some low levels of electromagnetic radiation could be generated from commonly used devices at construction sites, such as cellular telephones or portable computers. However, any electromagnetic radiation generated would be typical of that which exists throughout the human environment and is not anticipated to be harmful to human health.

Dismantling of the existing AN/GPN-20 would occur only after operation of the radar has ceased. Consequently, there should be no electromagnetic radiation hazard to workers involved in the AN/GPN20 dismantling. Similar to the ASR-11 construction, dismantling activities at the AN/GPN-20 site could generate low levels of electromagnetic radiation from commonly used devices, which are not anticipated to be harmful to human health.

4.12.2 Long-Term Impacts

Terms such as Asafety standards≅ and Aexposure standards≅ generally refer to, and are frequently used interchangeably with, specifications or guidelines on maximum public or occupational exposure levels to electromagnetic fields. Such levels are usually expressed as permissible exposure limits (PELs), threshold limit values (TLVs), or maximum power densities or field intensities in specific frequency ranges for stated exposure durations. Exposure guidelines have been developed by private organizations such as the American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE), and the National Council on Radiological Protection (NCRP, now called the National Council on Radiation Protection and Measurements) as voluntary guidelines for occupational or general public exposure, or both.

Governmental agencies such as the Federal Communications Commission (FCC) and various state and municipal bodies have adopted such guidelines or variations thereof as enforceable standards. The draft version of FAA Order 3910.3B, Radiation Safety Program (1997) adopts the ANSI/IEEE exposure guidelines.

The ANSI/IEEE guidelines cover the frequency range from 0.003 MHz to 300,000 MHz, and separately specify the maximum permissible exposure (MPE) in Auncontrolled environments≅ (accessible by the general population) and Acontrolled environments≅ (such as occupational exposure). In the ASR-11 frequency band of 2,700-2,900 MHz, the MPE for uncontrolled environments is 1.80-1.93 mW/cm^2 averaged over a 30-minute period. The guideline level for controlled environments is 9-10 mW/cm^2 averaged over a 6-minute period.

In 1988, the International Radiation Protection Association (IRPA) published guidelines for occupational and public exposure to electromagnetic radiation in the frequency range 0.001 MHz to 300,000 MHz. At the ASR-11 frequency, the MPE for occupational exposure is 5 mW/cm^2 averaged over a 6-minute period. The MPE for non-occupational exposure is 1 mW/cm^2 averaged over a 6-minute period. The MPE for pulsed electromagnetic radiation is set at 1,000 times that MPE for time-averaged exposure. Thus, at ASR-11 frequency, the MPE for pulsed electromagnetic radiation is 1,000 mW/cm^2 peak pulse power density.

The NCRP also published guidelines for human exposure. For electromagnetic radiation at ASR-11 frequency, the MPE for occupational exposure is 5 mW/cm^2, averaged over 6 minutes. The corresponding MPE for exposure of the general population is 1 mW/cm^2, averaged over 30 minutes.

In August 1996, the FCC adopted a hybrid standard based in part on the ANSI/IEEE guidelines and in part on the NCRP guidelines. For occupational exposure to electromagnetic radiation in the ASR-11 frequency band, the FCC MPE is the same as the NCRP guideline level.

The power density of ASR-11 beam varies considerably between the near-field (within 260 feet of the antenna) and the far-field (greater than 260 feet away) (FAA, 1997). Any differences in power densities would be conservative, because near-field calculations lead to lower predicted power densities than do far-field calculations. The power density of the ASR-11 signal can be represented by peak pulse power (the maximum power level of a single pulse) or as the power averaged over a time period, usually several or more minutes. At a distance of 23 m (75 feet) from the ASR-11 antenna, the peak power density of the

ASR-11 signal, which would be greater than the averaged power, would be 945 mW/cm^2, less than the 1,000 mW/cm^2 MPE for peak power density established by the IRPA, as discussed above. The peak power density will decrease rapidly with distance from the antenna. At all locations more than 23 m (75 feet) from the ASR-11 antenna, the ASR-11 signal will comply with the MPE for peak power density established by the IRPA.

The average (mean) power radiated by the ASR-11 is 2.1 kW. At any point near the ASR-11 in normal operation (i.e. antenna is rotating), the average power density is lower than the peak density by the factor 0.00034. For the ASR-11 frequency range (uncontrolled environments), the ANSI/IEEE MPE is 1.8 to 1.93 mW/cm^2, averaged over 30 minutes. The average power density of the ASR-11 signal decreases with distance from the antenna and will fall below 1.9 mW/cm^2 at a distance of 10 m (33 feet) from the radar antenna. Since the ASR-11 will be mounted on a tower greater than 10 m in height, persons at ground level would not be exposed to electromagnetic radiation levels exceeding the ANSI/IEEE MPE. At distances of more than 13 m (43 feet) from the ASR-11 antenna, the ASR-11 signal will comply with the MPE levels for the general population, 1.0 mW/cm^2, set forth in IRPA, NCRP, and FCC guidelines, discussed above. Thus no impacts to nearby receptors are anticipated at any of the three alternative sites. At all locations near the radar, the ASR-11 signal will comply by an even wider margin with the guideline levels for occupational exposure set forth by ANSI/IEEE, IRPA, NCRP, and FCC. As a precautionary measure, signs would be posted at the perimeter of the DASR facility advising personnel and the public against approaching the radar facility during operation.

On infrequent occasions, the ASR-11 antenna will remain stationary and transmit a signal for maintenance and testing purposes. This type of operation is expected to occur no more than once every several months. In maintenance mode, the ASR-11 signal will be directed at a fixed location above the horizon for up to several minutes at a time. Because the beam will be stationary, average power densities will be higher than during normal operation. In this mode, average power density of the main beam within 153 m (500 feet) of the ASR-11 will exceed the ANSI/IEEE guideline levels. During this mode of operation, the ASR-11 will be under the direct control of an operator at the radar site and exposure of humans within that distance of the radar is highly unlikely. At locations greater than 153 m (500 feet) from the ASR-11 antenna, the average power density of the signal from the ASR-11 operating in maintenance mode will comply with the ANSI/IEEE MPE for uncontrolled environments. At locations greater than 205 m (672 feet) from the ASR-11 antenna, the average power density of the signal from ASR-11 operating in maintenance mode will comply with the IRPA, NCRP, and FCC MPEs for uncontrolled environments.

5.0 COMPARISON OF ENVIRONMENTAL CONSEQUENCES AND SELECTION OF PREFERRED ALTERNATIVE

Each of the three alternative DASR sites would be acceptable from an environmental perspective. However, impacts associated with land use and aesthetic resources would be anticipated at **Sites 2** and **8**, and impacts associated with historic resources would be anticipated at **Site 5**. Due to operational and other base considerations, the Air Force has selected Site 8 as the preferred location.

Site 2 is located in an area designated for outdoor recreation. No significant adverse impacts associated with utilities, transportation, noise, air quality, geology, surface water, groundwater, biological resources, or cultural resources are anticipated if Site 2 were selected as the preferred alternative. The existing obstacle course could be relocated adjacent to the ASR-11 with no concern of electromagnetic radiation. However, the site=s potential future use for a portable radar and an Air National Guard training unit would be affected by the ASR-11. Site 2 is located adjacent to an off-base, private community composed of approximately 30 single-family homes. Thus, there is greater potential for off- base impacts to occur during construction and operation of the ASR-11. Locating the ASR-11 at Site 2 would result in short-term disruption to this neighborhood, and would result in a long-term change in aesthetic conditions. Visual impacts would be somewhat mitigated by an existing line of trees and shrubs.

Site 5 is located in an area classified as aircraft operations, and the construction and operation of the DASR facility would generally be compatible with the existing land use. No significant adverse impacts associated with land use, socioeconomics, utilities, transportation, noise, air quality, geology, surface water, groundwater, biological resources, or hazardous waste are anticipated if Site 5 were selected as the preferred alternative. Site 5 is located in close proximity to and visible from Building 1301, a National Register of Historic Places site which houses the Air Museum. The existing radar is also visible from the museum, therefore the construction of the new radar and removal of the existing radar would not substantially change aesthetic or cultural conditions and would not affect operations at the museum.

Site 8 is located on land classified as open space; however, it is located on the edge of a former landfill (LF-17). No significant adverse impacts associated with socioeconomics, utilities, transportation, noise, air quality, geology, surface water, groundwater, or biological resources are anticipated if Site 8 were selected as the preferred alternative. Although groundwater samples near the site have detected VOCs,

such as benzene, vinyl chloride, and tetrachloroethene, environmental staff at Dover AFB indicate that the groundwater plume associated with Site 8 has migrated southwest, and is not anticipated to pose a significant concern with regard to the siting of the ASR-11 (USAF, 2000). Site 8 is located near a base playground, as well as baseball and recreation fields, and across the perimeter road from a base family campground. There would be short-term impacts to these land uses during construction. DESHPO has raised concern regarding the potential for long-term aesthetic impacts of the proposed radar tower on three historic sites: the Dickinson Mansion, the John Wesley Cemetery, and the St. Jones Neck Homestead/Farm. A visual impact analysis was conducted at the request of the DESHPO (See Appendix C). The results of this analysis indicate that there would be no adverse impacts on these resources. While the ASR-11 would be visible from the southwest corner of the cemetery, the cemetery is located on base property and views would be consistent with other views of military activities and facilities.

6.0 MITIGATION

Issues that must be addressed during construction are elevated noise levels, increased dust, traffic and access disruption, aesthetic effects, site stability, hazardous waste, and groundwater and storm water management issues. Potential impacts in these areas can be reduced using standard mitigation measures.

During the construction period, sheeting or supports of some kind may be used in the areas excavated for the tower footings and utility trenches in order to prevent collapse of these excavated areas. Groundwater levels will be monitored and maintained as necessary. To minimize noise impacts during construction, mufflers would be used on construction equipment and vehicles. In addition, all equipment and vehicles used during construction would be maintained in good operating condition so that emissions are minimized, thus reducing the potential for air quality impacts. Temporary noise barriers, which have the indirect benefit of providing a visual buffer, may also be used to reduce noise levels. Dust will be controlled onsite by using water to wet down disturbed areas. All areas disturbed for the ASR-11 construction would be seeded with a grass mixture or covered with a geotextile fabric and crushed stone to stabilize the disturbed soils, in order to minimize the potential for erosion and sedimentation. All hazardous materials used during construction would be handled and disposed in accordance with Dover AFB policies and protocols and all applicable state and federal regulations. If groundwater is encountered at Site 8 during construction, the presence of contaminants would be monitored. Traffic management measures will be developed to facilitate traffic flow and pedestrian access.

During operation of the ASR-11, fuel would be stored in an above-ground storage tank (AST), and some hazardous materials, such as oil or grease, may be used at the site. Similar to the construction period, all hazardous materials used during operation would be used and disposed of in accordance with Dover AFB policies and protocols and all applicable state and federal regulations in order to minimize the potential for media contamination. Additionally, due to the potential for electromagnetic radiation hazards during operation, warning signs, indicating the safe distance from the operating radar, will be installed at the facility perimeter.

LIST OF ACRONYMS

AFB	Air Force Base
AICUZ	Air Installation Compatible Use Zone
ASR	Airport Surveillance Radar
AST	Above-ground Storage Tank
CEQ	Council on Environmental Quality
CRMP	Cultural Resource Management Plan
DASR	Digital Airport Surveillance Radar
dB	Decibel
dBA	Decibel, A-weighted
DESHPO	Delaware State Historic Preservation Office
DoD	Department of Defense
DOT	Department of Transportation
DNREC	Delaware Department of Natural Resources and Environmental Control
DNHI	Delaware Natural Heritage Inventory
EA	Environmental Assessment
EIS	Environmental Impact Statement
FAA	Federal Aviation Administration
FONSI	Finding of No Significant Impact
GIS	Geographic Information System
Hz	Hertz
IEEE	Institute of Electrical Electronics Engineers
IRP	Installation Restoration Program
IRPA	International Radiation Protection Association
LCF	Local Control Facilities
MCT	Military Control Towers
mgd	Million gallons per day
MPE	Maximum Permissible Exposure
msl	Mean sea level
NAAQS	National Ambient Air Quality Standards
NAS	National Airspace System
NASC	National Academy of Science
NEPA	National Environmental Policy Act
NRHP	National Register of Historic Places
NSC	National Safety Council
NWI	National Wetland Inventory
PEL	Permissible Exposure Limit
ppm	Parts per million
RAPCON	Radar Approach Control
RFR	Radio Frequency Radiation
SVOC	Semi-Volatile Organic Compound
USAF	United States Air Force
VOC	Volatile Organic Compound
VTDPS	Vermont Department of Public Services

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APPENDIX A: LISTING OF AGENCIES AND INDIVIDUALS CONTACTED

LISTING OF AGENCIES AND INDIVIDUALS CONTACTED

Dover AFB Environmental Flight, Dr. Milton Beck, PhD, 436 SPTG/CEV

Dover AFB Communications Squadron, Sergeant Burton

Dover AFB BioEnvironmental, Captain Woodriff

Dover AFB Radar Maintenance, Sergeant Lutz

APPENDIX B: PRELIMINARY SITE SCREENING CRITERIA FOR DOVER AFB

PRELIMINARY SITE SCREENING CRITERIA FOR DOVER AFB

EXCLUSIONARY CRITERIA

These criteria consider the essential environmental, constructional, and operational constraints that could eliminate a site from further consideration as a potential site for the ASR-11 System. These criteria relate to environmental parameters that could lead to unmitigable significant impacts and physical parameters regarding a site's suitability for construction.

Criteria	**Site 2**	**Site 3**	**Site 5**	**Site 6**	**Site 7**	**Site 8**	**Site 9**
Impacts occupied existing structures	No	No	No	No	No	No	No
Within railroad ROW	No	No	No	No	No	No	No
Within highway ROW	No	No	No	No	No	No	No
Within runways and/or taxiways	No	No	No	No	No	No	No
Within power line ROW	No	No	No	No	No	No	No
Impacts wilderness areas	No	No	No	No	No	No	No
Impacts national natural landmarks	No	No	No	No	No	No	No
Site less than 140 by 140 feet	No	Yes[1]	No	No[2]	No	No	No
Lacks coverage of aircraft targets within 1 nmi of the takeoff runway ends	No	Yes[3]	No	No	No	No	No
Lacks coverage of aircraft targets on final approach up to Missed Approach Point	No	Yes[3]	No	No	No	No	No
Within 1,500 feet of any above ground screening object	No	No	No	No	No	No	No
Cone of silence location impacts visibility of air routes or navigational fixes	No	No	No	No	No	No	No
Airport specific exclusions	No	No	No	No	No	No	No
Violates FAR Part 77 requirements	No	No	No	No	No	No	No

No = Meets Criteria
Yes = Does Not Meet Criteria

Notes:
Sites 1 and 4 were eliminated after initial screening due to proximity to aircraft movement areas or planned land use; they are not evaluated in this table.

[1] Site does meet the 140 x 140 site size, but would accommodate a modified site design

[2] Site requires tree clearing

[3] Coverage of aircraft targets on approach to Runway 14 or departing Runway 32 is degraded by the 0.5 nmi minimum detection range

Source: U.S. Air Force, 1999a

RESTRICTIVE SCREENING CRITERIA

These criteria could eliminate a site from further consideration due to the extensive mitigation required to offset potentially significant impacts. Many of these criteria originate from Federal law. In these cases, the law has been noted. Additionally, many of the criteria are covered by state and local laws, which were consulted as appropriate.

Criteria	**Site 2**	**Site 3**	**Site 5**	**Site 6**	**Site 7**	**Site 8**	**Site 9**
Ecological or wildlife refuges	5	5	5	5	5	5	5
Wild and scenic rivers	5	5	5	5	5	5	5
Prime farmland	3[a,d]	3[c,d]	3[c,d]	3[b,c,d]	3[c,d]	5[b,c,d]	3[c,d]
National, state, and municipal parks and recreation areas	5	5	5	5	5	5	5
Historical, archeological, and cultural sensitive sites	5	5	5	5	5	5	5
Wetlands	5	5	5	5	5	5	5
Endangered and threatened species habitat	5	5	5	5	5	5	5
Non-airfield or non-federal land	5	5	5	5	5	5	5
Hazardous waste site	5	5	3[e]	5	5	3[e]	5
Capped landfill	5	5	5	5	5	5	5
Scenic highways	5	5	5	5	5	5	5
Coastal zones	5[f]	5[f]	5[f]	5[f]	5[f]	5[f]	5[f]
Steep terrain	5	5	5	5	5	5	5
Floodplain	5	5	5	5	5	5	5
Within 2,500 feet of existing electronic facilities or power lines that could interfere with operation	1 trans-itter site	5	1 AN/GPN-20	5	5	5	5
Primary radar coverage to the threshold of runways	3 Runway 19	3 Runway 14	3 Runway 01/32	5	5	3 Runway 32	3 Runway 01
Secondary radar coverage, on the surface, over the entire length of runways	3	3	3	3	3	3	3
Within 2,500 feet of industrial operations that could interrupt or contaminate the site	5	5	5	5	5	5	5
Within 0.5 nmi of edges of any operational runways and approach and departure paths	3 Runway 19	3 Runway 14	3 Runway 01/32	5	5	3 Runway 32	3 Runway 01

5 = No Adverse Impacts/Meets Criteria
3 = Partially Impacted/Marginal
1 = Significantly Impacted/Does Not Meet Criteria

[a] Soil listed as prime and unique farmland soil.
[b] Adjacent to mapped soil listed as prime and unique farmland soil.
[c] No soil mapping available for site.
[d] No active agricultural use.
[e] IRP site ROD for Site 5 indicates 'No Further Action", for Site 8 recommends "Natural Attenuation".
[f] The entire state of Delaware is identified as a Coastal Zone.

Source: U.S. Air Force, 1999a

SELECTIVE SCREENING CRITERIA

These criteria provide positive or negative considerations that will form the basis for comparison of candidate sites. Much of the information required will be obtained during site visits.

Criteria	**Site 2**	**Site 3**	**Site 5**	**Site 6**	**Site 7**	**Site 8**	**Site 9**
Visual sensitivity	0	0	+	0	+	0	+
Accessibility to roads	+	+	+	+	+	+	+
Soils	TBD	TBD	TBD	TBD	TBD	TBD	TBD
Geology	TBD	TBD	TBD	TBD	TBD	TBD	TBD
Proximity to power	+	+	+	0	+	+	+
Proximity to telephone lines	+	+	+	0	+	+	+
Zoning	+	+	+	+	+	+	+
Subsurface rights	0	0	0	0	0	0	0
Unique habitat	0	0	0	0	0	0	0
Utilities	+	+	+	0	+	+	+
Planned use of site	+	0	+	+	+	0	+
Roadways	+	+	+	+	+	+	+
Water resources	0	0	0	0	0	0	0
Recreational use	+	+	+	+	+	-	+
Bodies of water	0	0	0	0	0	0	0
Underground cable routing	+	+	+	0	+	+	+
LOS visibility to air traffic coverage requirements	0	0	0	0	0	0	0

+ = Positive
– = Negative
O = Neutral

Source: U.S. Air Force, 1999a

APPENDIX C: VISUAL IMPACT ANALYSIS

Appendix C
Visual Impact Analysis

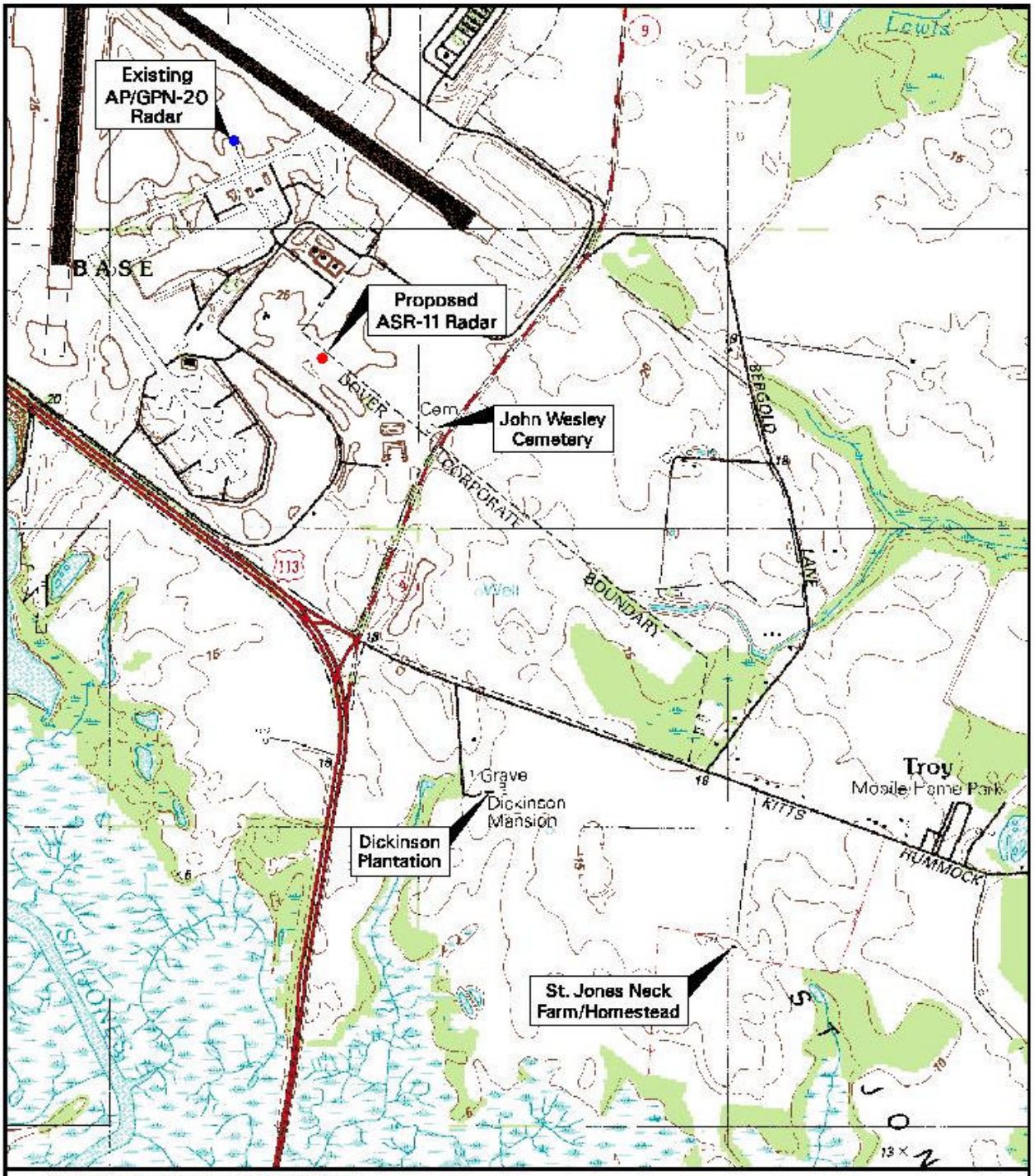
Assessing the visual sensitivity of an action is important in determining the effect that action has on visual resources in a given region. Visual resources include both natural and manmade features of the surrounding environment and contribute to the aesthetic quality of an area. Manmade features are considered characteristic of an area if they are inherent to the structure and function of a region.

The importance of a change in visual resources is influenced by social considerations. These changes may alter the public perception of an important visual resource of natural or historic significance. Visual sensitivity is defined as the degree of public interest in a visual resource and concern over adverse changes in the quality of the resource (BLM, 1978; USFS, 1974). When assessing the effect of a given action on visual resources, it may be important to determine the visual sensitivity of a given effect, under what condition the effect is seen, and whether or not it represents a significant impact to visual resources.

The purpose of this visual impact analysis is to determine what, if any, impact the new ASR-11 radar at Dover AFB would have on the surrounding landscape. Of greatest concern are three resources of historic importance located to the east and southeast of the proposed ASR-11 site. The proposed location (Site 8) of the new ASR-11 radar is located within the southeast corner of the base (See Figure C-1).

1.0 Historic Resources in Vicinity of Proposed Radar Site

Two resources of historic importance are located southeast of Dover Air Force Base. These resources include the Dickinson Plantation and the St. Jones Neck Homestead/Farm. A third historic resource, the John Wesley Cemetery, is located on base property east of the existing firing range. The John Wesley Cemetery is the closest of the three historic resources to the proposed ASR-11 site at approximately 1,500 feet. The St. Jones Neck Homestead/Farm is the farthest from the ASR-11 site at approximately 7,900 feet. The Dickinson Plantation is approximately 5,200 feet from the proposed ASR-11 site (See Figure C-1).



Source: Dover Quadrangle from USGS.
Contour interval: 5 feet.

1500 0 1500
SCALE IN FEET

N

FIGURE C-1.

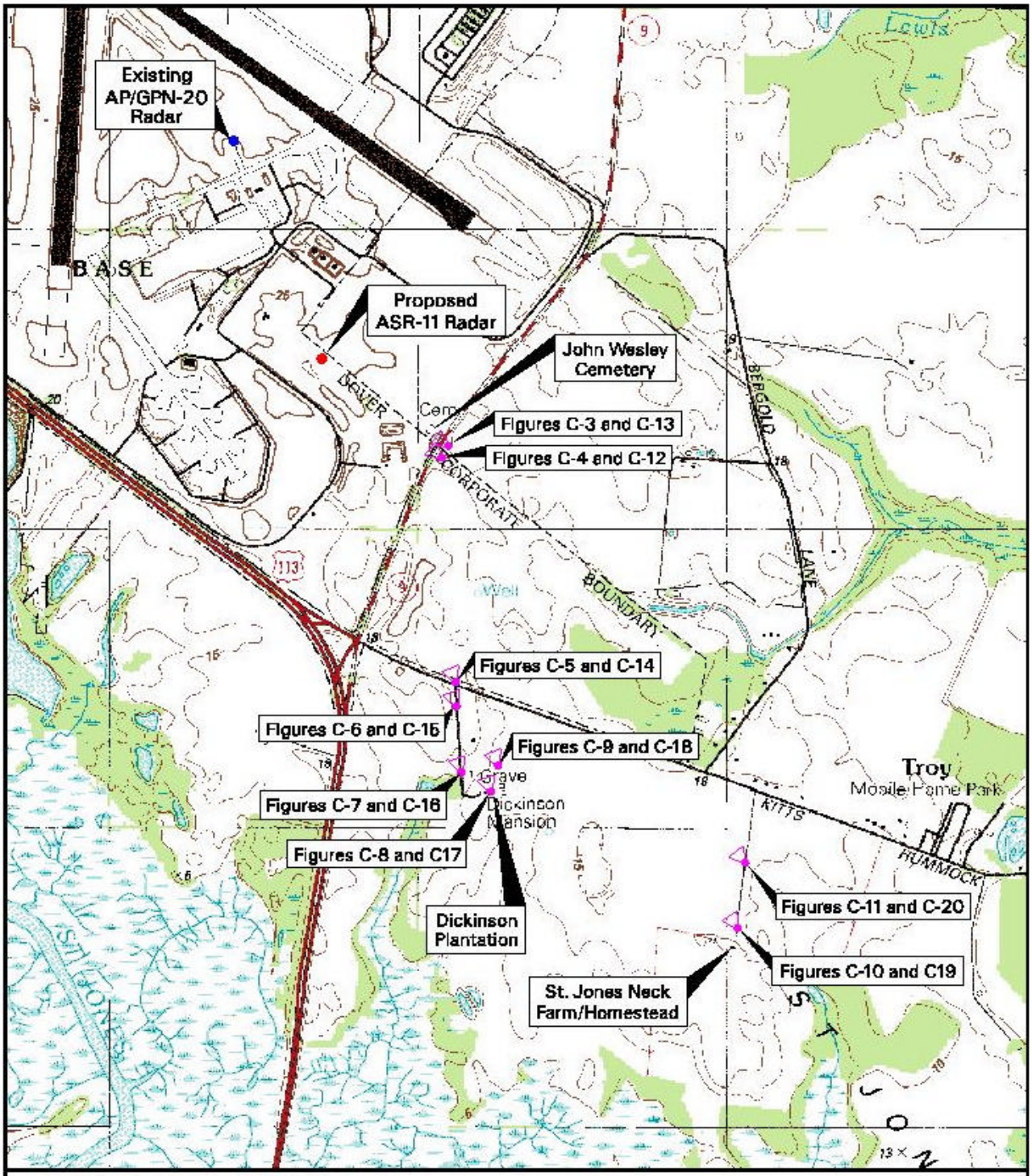
HISTORIC RESOURCES SOUTH OF DOVER AFB

/u5/oldjobs/dover/landmrk

2.0 Visual Analysis Methodology

Due to its relative location, it was determined that Site 8 would have the greatest potential visual impact, if any, on the three historic resources. Therefore, potential visual impacts from the proposed ASR-11 radar at site 8 were analyzed by a red balloon test and subsequently by photo-simulation methodology. The red balloon test was conducted on Friday, November 12. The test was conducted in late fall so that foliage would be gone from deciduous vegetation. A 100 gram three-foot diameter meteorological red balloon was filled with helium. The line on the balloon was let out to a height of 107 feet representing the height of the radar tower and antenna; however, wind gusts developed and were so strong that the balloon did not reach correct elevation. The test was also called off because base firing range personnel indicated the site had to be cleared to allow a training session at the nearby firing range. It was, therefore, determined that a photo-simulation would be conducted to assess the visibility of the proposed radar at the site. Therefore, photos of the proposed ASR-11 location at Site 8 were taken from the three historic resources from a number of vantage points. From these photos, nine were chosen for the photo-simulation. Of these nine photos, five were from the Dickinson Plantation, two were from the St. Jones Neck Homestead/Farm, and two were from the John Wesley Cemetery (See Figure C-2). The final assessment of possible impacts from the proposed ASR-11 radar station was reached by considering both field observations and photo-simulation results.

The field observations provided characterization of existing conditions and provided the basis for assessing whether or not the proposed ASR-11 radar would be incompatible with the surrounding landscape. The photo-simulation allowed imposition of an image of an ASR-11 radar tower onto the existing conditions photos to determine the level of visual impact at the three historic resources. Significance of impact was determined based on visual dominance and visual sensitivity.



Source: Dover Quadrangle from USGS.
Contour interval: 5 feet.

1500 0 1500
SCALE IN FEET

N

FIGURE C-2.

VIEWING LOCATIONS SOUTH OF DOVER AFB

/u6/.../dover/topoloc2

The photo-simulation was accomplished by creating, in AutoCAD, a 3D model of the proposed ASR-11 radar using details obtained from the systems contractor's design drawings. Once the ASR-11 tower was created in AutoCAD the file was transferred into 3D MAX, which allows the placement of the radar at the correct elevation and distance in the context of the existing landscape. Distances from the proposed radar tower to the viewing locations, as well as the elevation of the proposed radar tower were obtained from the USGS map (Figure C-2).

Visual Dominance. The extent to which a feature is noticeable depends on its visual dominance relative to the affected landscape. There are four levels of visual dominance, termed visual modification (VM) classes (USAF, 1987). These include:

- CLASS 1, NOT NOTICEABLE. Changes in the landscape are within the field of view but would generally be overlooked by all but the most interested viewers. Due to such factors as distance, screening, and similarity in shape and color to surrounding landscape features, the changes generally are not noticed unless pointed out.

- CLASS 2, NOTICEABLE, VISUALLY SUBORDINATE. Changes in the landscape are noticeable to most viewers without being pointed out. They may attract some attention but do not compete for it with other features in the field of view. Such changes often are perceived as being in the background.

- CLASS 3, DISTRACTING, VISUALLY CO-DOMINANT. Changes in the landscape compete for attention with other features in view (attention is drawn to the change about as frequently as to other features in the landscape).

- CLASS 4, VISUALLY DOMINANT. Changes in the landscape are the focus of attention and tend to become the subject of the view; such changes often cause a lasting impression of the affected landscape.

Visual Sensitivity. The approach used to define visual sensitivity reflects the concepts and methods of several federal agencies, which treat sensitivity as a function of viewer activity, awareness, values, and goals (USAF, 1987). For example, individuals engaged in outdoor activities, such as camping or hiking, would be more apt to notice their surroundings than those commuting in heavy traffic. Viewer awareness may also be heightened where areas are formally classified or otherwise designated as being of special interest (i.e. national historic monuments, state or federal parks, or scenic route/overlook).

When determining whether or not a proposed action will have a visual impact, it is important to speak of "sensitive views". The most sensitive views are those from public travel routes (e.g. roads, trails, bicycle paths, and navigable streams and rivers) and common-use areas (e.g. campsites, scenic overlooks, lakes, recreation sites, parks, historic landmarks, and residential areas) (USAF, 1987).

Visual sensitivity may be rated as high, medium, or low, based on the following criteria. High sensitivity occurs when the public can be expected to react strongly to a threat to visual quality. Concern is deep and widespread because the affected views are rare, unique, or in other ways special to the region or locale. Medium sensitivity occurs when affected views are secondary in importance or are similar to others in the region or locale. Low sensitivity exists when the public can be expected to have little or no concern about changes in the landscape. Little value may be ascribed to the views, or they may be similar to many others in the area. These criteria were used to assess the potential visual impacts of locating the ASR-11 tower and antenna at Site 8.

3.0 Existing Conditions

Dover AFB is located southeast of the City of Dover in Kent County, Delaware. The existing land use west of the base is primarily commercial and industrial, with some residential areas present north of the base adjacent to the City of Dover. Much of the land uses north, south and east of the base are agricultural and conservation areas (USAF, 1998b). The base itself is comprised of a multitude of land uses, ranging from industrial to open space (Table 3.1-1, Figure 3.1-1 of the Final EA). Areas within the vicinity of Site 8 are categorized as a mixture of industrial, airfield, outdoor recreation and open space. The surrounding topography of the base is relatively flat. The change in elevation ranges from 5 to 25 feet. This variation occurs gradually and no hills occur within the vicinity of the base.

Photographs were taken at each of the three historic resources from different vantage points in the direction of the existing and proposed radar locations. The existing radar tower is visible in several of these photographs. From other vantage points, the existing radar is not visible due to the presence of trees or other structures. Photographs shown in

Figures C-3 and C-4 were taken from the south side of the John Wesley Cemetery. The existing AN/GPN-20 radar is hidden behind existing vegetation. Photographs shown in Figures C-5 through C-9 were taken from the Dickinson Plantation. The existing AN/GPN-20 radar is only visible in Figures C-5 through C-7. Due to the tower height and distance from the Dickinson Plantation the existing radar tower blends into the surrounding tree line in these three figures. From the St. Jones Neck Homestead/Farm the existing radar is also not visible (Figures C-10 and C-11). The tree line on the horizon obscures the view of the existing radar.

4.0 Impacts from the Proposed ASR-11 at Site 8

The proposed ASR-11 radar tower would be located on Dover AFB on Site 8, which is approximately 2,600 southeast of the existing AN/GPN-20 radar tower. The height of the proposed tower would be 87 feet while the height including the radar antenna would be 107 feet. Lightning masts would add another nine feet to the radar antenna height of 107 feet, but these would be barely visible from any distance.

During construction, no clearing of existing trees or shrubs would occur. Modification of landforms is a general concern in visual analyses, however, construction of the ASR-11 at Site 8 would require little or no modification to the surrounding landscape. Due to the level nature of the base, minimal grading would be needed and would be primarily confined to the tower footprint and access road.

Since the ASR-11 radar would be unmanned and seldom visited, the visual impacts of operation would relate mainly to the appearance of the facility. The following discussion describes the range of conditions under which the proposed ASR-11 radar tower might be viewed and assesses what the visual impacts would be for those conditions.

Figure C-3. View of Base Along the Southwest Border of the John Wesley Cemetery.

Figure C-4. View of the John Wesley Cemetery and Base from Delaware State Highway 9.

Figure C-5. View of Base and Existing Radar From the end of the Dickinson Plantation Driveway

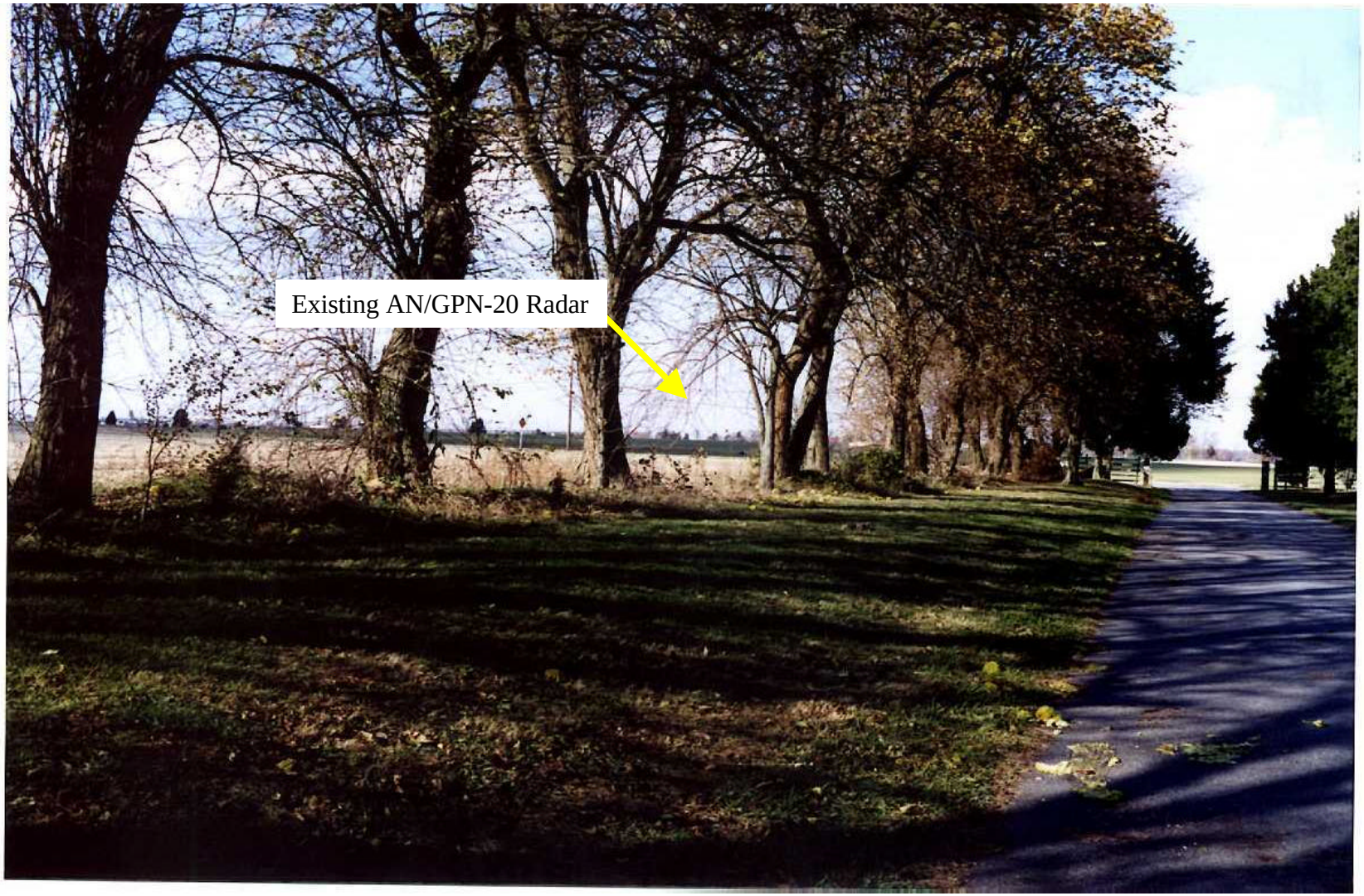


Figure C-6. View of the Base and Existing Radar at the Mid-point of the Dickinson Plantation Driveway

Figure C-7. View of the Base and Existing Radar at the South End of the Dickinson Plantation Driveway

Figure C-8. View of the Base and Existing Radar from the Dickinson Plantation Doorstep.

Figure C-9. View of the Base and Existing Radar from the East Side of the Dickinson Plantation Mansion.

Figure C-10. View of the Base and Existing Radar at the St. Jones Neck Homestead/Farm

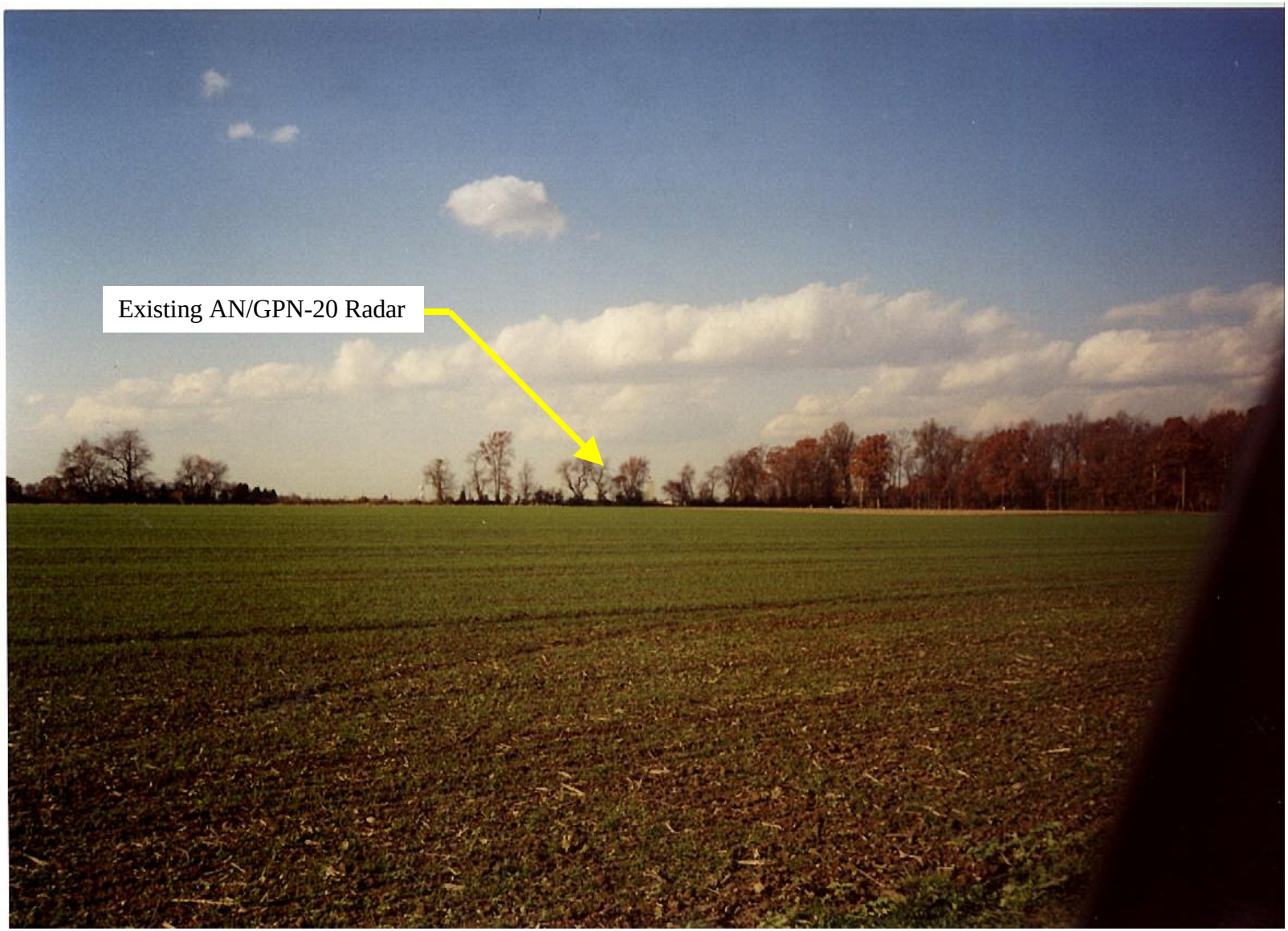


Figure C-11. View of the Base and Existing Radar from the Midpoint of the St. Jones Neck Homestead/Farm.

The impact analysis utilized the following assumption. Each view would be in a "normal" range of vision, that is, a usual field of view relative to the activity engaged in. For people in automobiles, normal viewing is expected to occur horizontally within a 130° width-of-field oriented in the direction of travel. For stationary viewing at public-use areas, such as the three historic resources located next to the base, normal viewing is assumed to occur in all directions. This is particularly true of the St. Jones Neck Homestead/Farm, which is occupied.

Distance. The distance from which an object is viewed affects the degree of contrast it may have in the landscape. Color and texture are attenuated with distance, as is the apparent size of the object. At a distance, an object loses much of its identity. The John Wesley Cemetery is located only 1,500 feet from the proposed radar site, and at such a distance the proposed ASR-11 radar tower would be noticeable in the landscape. While the gray color and open nature of the tower would not be distinct at this distance, the red antenna would be visible when viewed from the southeastern side of the cemetery (See Figure C-12). However, when viewing the cemetery directly from the south, adjacent to Route 9, the proposed ASR-11 radar would not be visible due to the dense vegetation (See Figure C-13). Pictures for the photo-simulation were taken during mid-November when much of the foliage had fallen from the trees and other vegetation. This photo-simulation suggests that a visual impact from directly south of the cemetery would be minimal year round.

Distances are greater from the proposed radar site to the Dickinson Plantation and St. Jones Neck Homestead/Farm, thus reducing the dominance of the proposed ASR-11 radar (See Figures C-14 through C-20) in the surrounding landscape. While the radar does stand above the tree line in Figure C-14, it does not dominate the surrounding landscape. Also, the variation of the tree line reduces the focus on the radar tower, thus further reducing the viewer's awareness.

Focal-Point Sensitivity. Viewer's attention and awareness are heightened when there are focal points. Such points may be created by an abrupt change in the sequence or

Figure C-12. View of Proposed ASR-11 Radar From the Southwest Border of the John Wesley Cemetery.

Figure C-13. View of the Proposed ASR-11 Radar from the South Side of the John Wesley Cemetery.

Figure C-14. View of Proposed ASR-11 Radar from the end of the Dickinson Plantation Driveway.

Figure C-15. View of the Proposed Radar at the Mid-point of the Dickinson Plantation Driveway.

Figure C-16. View of Proposed ASR-11 Radar From the South End of the Dickinson Plantation Driveway.

Figure C-17. View of the Proposed ASR-11 Radar from the Dickinson Plantation Doorstep.

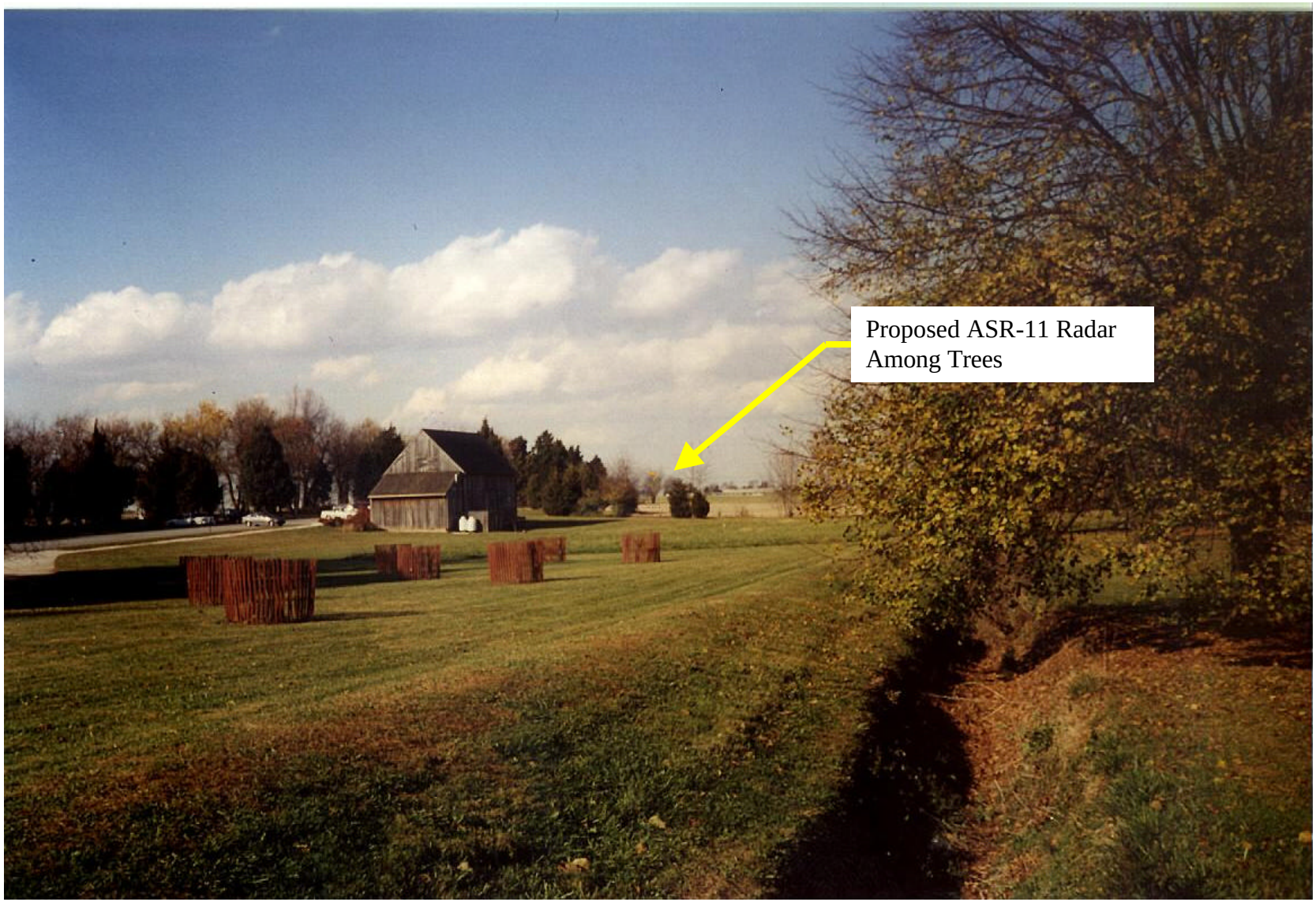


Figure C-18. View of the Proposed ASR-11 Radar from the East Side of the Dickinson Plantation Mansion.

Figure C-19. View of the Proposed ASR-11 Radar from the St. Jones Neck Homestead/Farm

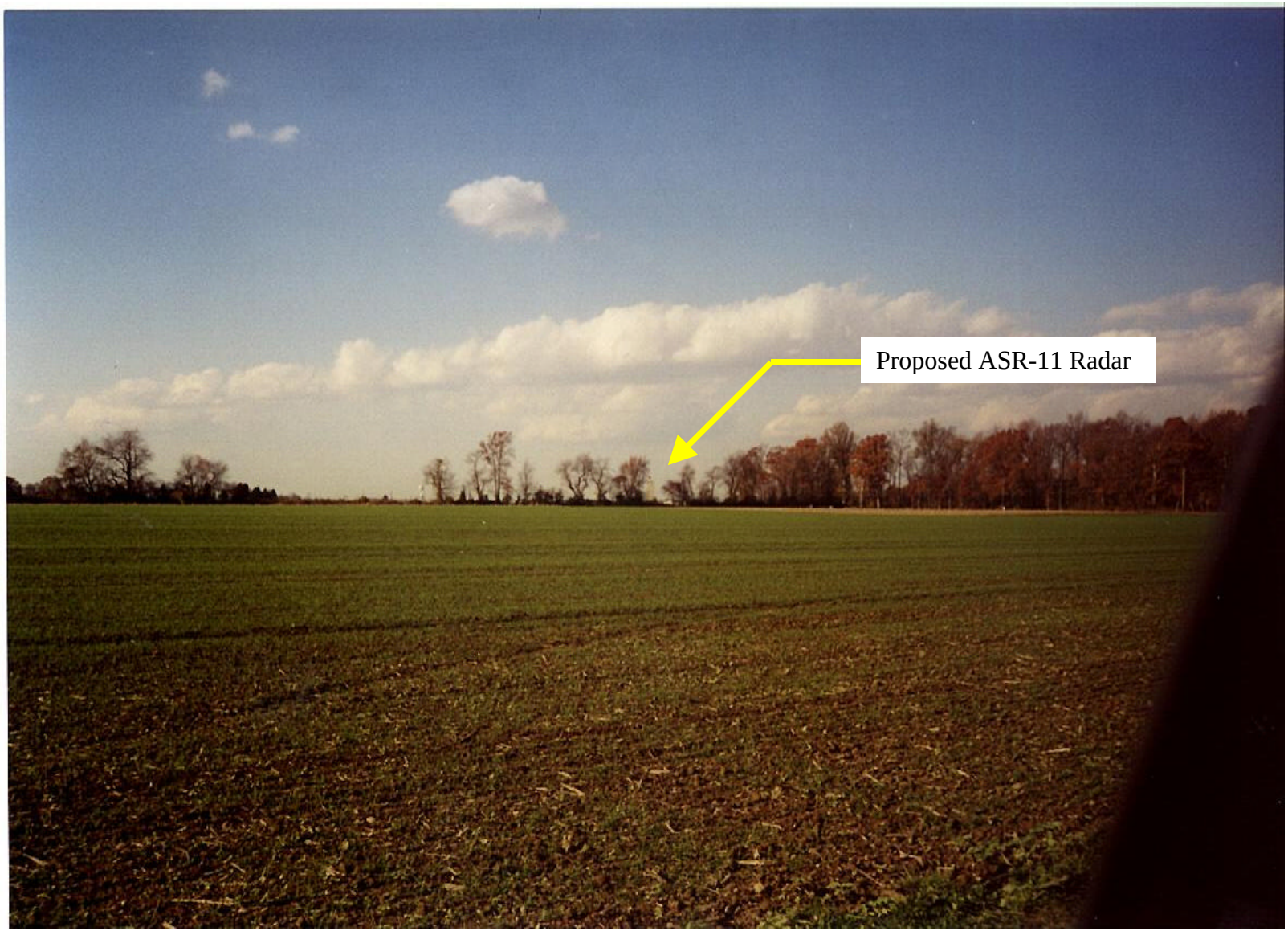


Figure C-20. View of Proposed ASR-11 Radar from the Midpoint of the St. Jones Neck Homestead/Farm.

pattern of landscape features, a sharp discontinuity in overall landscape character, or an unexpected shift in viewing direction due to road alignment or topography. Most often, focal-point sensitivity occurs when lines, such as ridges, roads, or bordering vegetation help to emphasize a landscape feature which otherwise would not be apparent. With regard to the proposed ASR-11 radar tower, the only historic resource at which focal-point sensitivity would be an issue is the John Wesley Cemetery. The gap in the vegetation to the north of the cemetery acts as a focal-point with the proposed ASR-11 radar occurring within the vegetation gap (See Figure C-12). However, due to the relative height of the surrounding vegetation and security fence, the tower does not dominate the landscape. No focal points exist from the two remaining historic resources. For example, in Figure C-14 the proposed ASR-11 radar tower is higher than the surrounding tree line, but there are no abrupt changes in the surround landscape that clearly point to the proposed tower. When looking towards the proposed ASR-11 radar from St. Jones Neck Homestead/Farm, there are no clear focal points drawing attention to the tower (See Figure C-20)

Skyline Complexity. The complexity of the skyline is an important factor in determining how noticeable a new structure, such as the proposed radar tower, might be. Skyline complexity is the degree of irregularity created at the horizon by masses of vegetation, abrupt changes in topography, or structures. Skyline complexity is also influenced by how vertically pronounced the irregularity may be, or its degree of relief. When the irregularity of the skyline is great and vertically pronounced, the skyline appears highly complex. The more complex the skyline, the more likely it is that a radar tower would not be noticed. The proposed ASR-11 radar tower, from either the Dickinson Plantation or the St. Jones Neck Homestead/Farm, would appear to be only one of many projections along the skyline, and would be relatively inconspicuous (See Figures C-14 through C-20). Due to its closer proximity to the John Wesley Cemetery, the proposed ASR-11 radar would be more obvious from the southwestern side of this resource, however, the tower would still not represent an abrupt change in the skyline.

Conclusion. The level of visual impact from the proposed ASR-11 radar at Site 8 appears minimal. Utilizing the classification of visual dominance described in Section 2.0, the proposed ASR-11 radar would be categorized as CLASS 3 from the perspective of the John Wesley Cemetery, co-dominant with the surrounding landscape features (See Figure C-12). This means that while the tower may be noticeable to most viewers, it will compete equally with other features in the surrounding landscape for primary attention. From Dickinson Plantation the proposed ASR-11 radar tower would be classified as CLASS 2 under the visual dominance classification system, noticeable but visually subordinate to the surrounding landscape (See Figure C-14). This means that while the tower may be noticeable to some viewers without being pointed out, it does not detract from the surrounding area. The ASR-11 would have no impact at the St. Jones Neck Homestead/Farm historic site. Under the classification of visual dominance, the proposed ASR-11 radar would be categorized as CLASS 1, not noticeable in the surrounding landscape (See Figure C-19 and C-20). This means that the radar would not be noticeable and would be overlooked by all but the most interested viewers.

The visual sensitivity of the proposed ASR-11 radar would be low given its location on the base. While the tower would be located in the vicinity of three historical resources it would not be out of character with surrounding land usage, including runways, hangers, and the firing range. Existing views toward the base from private property or local roads are generally not considered 'sensitive views' when compared to views from visually sensitive areas such as scenic roads, overlooks, bicycle paths, or scenic rivers. Little value is expected to be ascribed to the view towards the base. For this reason the visual sensitivity is expected to be low with regard to the proposed ASR-11 radar. The proposed radar tower would not greatly change the visual quality of the base, and the public would not be expected to react strongly to the change in view. The proposed radar will be similar to the existing radar, which will be removed, and from many viewpoints the net visual change would be minimal. The existing radar tower is painted, however the proposed radar tower will not be painted except for the radar antenna.

Attachment C References

Bureau of Land Management, U.S. Department of the Interior (BLM). 1978. USDI Manual 8411, Upland Visual Resource Inventory and Evaluation. Washington, D.C.

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