4.4 AIR QUALITY

This air quality analysis includes a description of the existing air quality conditions, a general conformity analysis, a regulatory review, and a discussion of microscale carbon monoxide (CO) concentrations resulting from potential changes in traffic patterns because of implementing of the alternatives.

4.4.1 AFFECTED ENVIRONMENT

4.4.1.1 National Ambient Air Quality Standards and Attainment Status

Main Post, EPG, and the GSA Parcel. U.S. Environmental Protection Agency (EPA) Region 3 and the Virginia Department of Environmental Quality (VDEQ) regulate air quality in Virginia. The Clean Air Act (CAA) (42 U.S.C. 7401-7671q), as amended, gives EPA the responsibility to establish the primary and secondary National Ambient Air Quality Standards (NAAQS) (40 CFR Part 50) that set acceptable concentration levels for seven criteria pollutants: particulate matter (PM_{10}), fine particulate matter ($PM_{2.5}$), sulfur dioxide (SO_2), carbon monoxide (CO), nitrous oxides (NOx), Ozone (O_3), and lead. Short-term NAAQS (1-, 8-, and 24-hour periods) have been established for pollutants contributing to acute health effects, while long-term NAAQS (annual averages) have been established for pollutants contributing to chronic health effects. Each state has the authority to adopt standards stricter than those established under the federal program; however, the Commonwealth of Virginia accepts the federal standards. Appendix E.3 describes each of the criteria pollutants' sources and impacts on public health and welfare.

Federal regulations designate Air-quality Control Regions (AQCRs) in violation of the NAAQS as *nonattainment* areas. Federal regulations designate AQCRs with levels below the NAAQS as *attainment* areas. *Maintenance* AQCRs are areas that have previously been designated *nonattainment* and have been redesignated to *attainment* for a probationary period through implementation of maintenance plans. According to the severity of the pollution problem, nonattainment areas can be categorized as marginal, moderate, serious, severe, or extreme.

Fairfax County (and therefore Fort Belvoir Main Post, EPG and the GSA Parcel) is within the National Capital Interstate AQCR (AQCR 47) (40 CFR 81.12). AQCR 47 is in the O_3 transport region (OTR) that includes 22 states and Washington, DC. EPA has designated Fairfax County as the following:

- Moderate nonattainment for the 8-hour O_3 NAAQS
- Nonattainment for the $PM_{2.5}$ NAAQS
- Attainment for all other criteria pollutants (40 CFR 81.347)

4.4.1.2 State Implementation Plan

The CAA, as amended in 1990, mandates that state agencies adopt State Implementation Plans (SIPs) that target the elimination or reduction of the severity and number of violations of the NAAQS. SIPs set forth policies to expeditiously achieve and maintain attainment of the NAAQS.

Because monitored levels of O_3 in the Washington, DC Metropolitan Area exceeded the 1-hour NAAQS, the Commonwealth of Virginia, State of Maryland, and Washington, DC were required to develop SIPs that outline the actions that would be taken to achieve the 1-hour NAAQS before

2007. The current SIP presents the regional air quality plan for attainment of the federal 1-hour NAAQS for ground-level O_3 developed by the Metropolitan Washington Air Quality Committee (MWAQC) for the Washington, DC multijurisdictional nonattainment area. MWAQC was established in accordance with Section 174 of the CAA by the governors of Maryland and Virginia, and the mayor of the District of Columbia to prepare a regionally coordinated air quality plan to comply with these requirements.

The current EPA-approved regional air quality plan is the *State Implementation Plan—Plan to Improve Air Quality in the Washington, DC–MD–VA–Region* (MWCOG, 2004a). This SIP revision estimates a total daily emissions inventory of 487.5 tons per day (tpd) of NOx and 325.8 tpd of volatile organic compounds (VOC) for the region.

Currently the region has no applicable SIP for the 8-hour O_3 or the $PM_{2.5}$ NAAQS. The SIP revisions to address nonattainment conditions with respect to the new 8-hour O_3 and $PM_{2.5}$ NAAQS are being developed and are expected to be approved by EPA by 2008 and 2009, respectively. In the interim period, EPA has published some guidance to address compliance with the CAA regarding these new NAAQS (USEPA, 2004; 2005a; 2005b; and 2006b). In addition, in December of 2006 a federal appellate court partially invalidated EPA's implementation of the 8-hour ozone standard (U.S. Court of Appeals, 2006). As of this time, no changes in effective regulations or guidance have been issued based on this court decision.

Since 1990, Virginia has developed a core of air quality regulations that have been approved by EPA. These approvals signified the development of the general requirements of the Virginia SIP. The Virginia program for regulation of air emissions affects industrial sources, commercial facilities, and residential development activities. Regulation occurs primarily through a process of reviewing engineering documents and other technical information, applying emission standards and regulations in the issuance of permits, performing field inspections, and assisting industries in determining their compliance status with applicable requirements.

4.4.1.3 Clean Air Act Conformity

Main Post, EPG, and the GSA Parcel. The 1990 amendments to the CAA require federal agencies to ensure that their actions conform to the SIP in a nonattainment area. EPA has developed two distinctive sets of conformity regulations: one for transportation projects and one for nontransportation projects. Nontransportation projects are governed by general conformity regulations (40 CFR Parts 6, 51 and 93), described in the final rule for *Determining Conformity of General Federal Actions to State or Federal Implementation Plans,* published in the *Federal Register* on November 30, 1993. The general conformity rule became effective January 31, 1994. Under Section 176(c) of CAA, the general conformity rule became applicable one year after the O_3 and the $PM_{2.5}$ nonattainment designations became effective. In addition, Virginia has adopted conformity regulations (9 Virginia Administrative Code [VAC] 5-160-10 through 9 VAC 5-160-200). The Virginia General Conformity regulations were approved as part of the SIP by EPA on January 7, 2003 (68 FR 723). This occurred after the new O_3 NAAQS were approved but before they went into effect, so it is likely that the approved rules were written with the new standards in mind.

The proposed action is a nontransportation project within a nonattainment area. Therefore, a general conformity analysis is required with respect to the 8-hour O_3 and $PM_{2.5}$ NAAQS. Under the general conformity rule, a project conforms if such activities DO NOT

- Cause or contribute to any new violations of an NAAQS in an area

- Increase the frequency or severity of any existing violation of any NAAQS in an area
- Delay timely attainment of any NAAQS or any required interim emission reductions or other milestones in an area

The general conformity rule specifies threshold emission levels by pollutant to determine the applicability of conformity requirements for a project (Table 4.4-1). For an area in moderate nonattainment for the 8-hour O_3 NAAQS within the OTR, the applicability criterion is 100 tons per year for NOx and 50 tons per year for VOCs (40 CFR 93.153). For an area in nonattainment for the $PM_{2.5}$ NAAQS, the applicability criterion is 100 tons per year for $PM_{2.5}$, NOx, and SO_2 (USEPA, 2006b). VOCs and ammonia were also identified as potential $PM_{2.5}$ precursors. However, neither Virginia nor EPA has found that ammonia contributes to $PM_{2.5}$ problems in AQCR 47 or other downwind areas. Therefore, ammonia was not carried forward for detailed analysis. Appendix E.1 presents an applicability analysis and general conformity determination (GCD) under the general conformity rule.

Table 4.4-1
Applicability thresholds for nonattainment areas

Criteria pollutants	Applicability threshold (tpy)
O_3 (NO_x or VOCs)	
Serious NAAs	50
Severe NAAs	25
Extreme NAAs	10
Other O_3 NAAs outside an O_3 transport region	100
Marginal and moderate NAAs inside an O_3 transport region	
VOC	50
NO_x	100
CO	100
All NAAs	100
SO_2 or NO_x	
All NAAs	100
PM_{10}	
Moderate NAAs	100
Serious NAAs	70
$PM_{2.5}$ ($PM_{2.5}$, NO_x, SO_2)	
All NAAs	100
Lead	
All NAAs	25

Sources: 40 CFR 93.153; USEPA, 2006b.

Notes:

tpy = tons per year

NAA = nonattainment area

4.4.1.4 Local Ambient Air Quality

Main Post, EPG, and the GSA Parcel. Existing ambient air quality conditions in the vicinity of Fort Belvoir can be estimated from measurements conducted at air quality monitoring stations close to the installation. The most recent available data from VDEQ for nearby monitoring stations are used to describe the existing ambient air quality conditions at Fort Belvoir (Table 4.4-2). With the exception of the 8-hour O_3 NAAQS, most recent air quality measurements are below the NAAQS (VDEQ, 2005a). The reported measurement of 0.093 parts per million (ppm) for the 8-hour level exceed the NAAQS of 0.08 ppm. This exceedence is expected, because the region has been designated an O_3 nonattainment area.

Table 4.4-2
2005 Local ambient air quality monitoring results

Pollutant	Primary NAAQS[a]	Secondary NAAQS[a]	Monitored data[b] (regional maximum)	Location where maximum was recorded
CO				
8-Hour Maximum[c] (ppm)	9	None	1.7	Fairfax County
1-Hour Maximum[c] (ppm)	35	None	2.7	Alexandria
NO_2				
Annual Arithmetic Mean (ppm)	0.053	0.053	0. 024	Alexandria
O_3				
8-Hour Maximum[d] (ppm)	0.08	0.12	0. 097	Fairfax County
$PM_{2.5}$				
Annual Arithmetic Mean[e] ($\mu g/m^3$)	15	15	15. 3	Arlington
24-Hour Maximum[f] ($\mu g/m^3$)	65	65	37.7	Loudoun County
PM_{10}				
Annual Arithmetic Mean[g] ($\mu g/m^3$)	50	50	20	Fairfax County
24-Hour Maximum[c] ($\mu g/m^3$)	150	150	59	
SO_2				
Annual Arithmetic Mean (ppm)	0.03	None	0.006	Fairfax County
24-Hour Maximum[c] (ppm)	0.14	None	0.021	Fairfax County
3-Hour Maximum[c](ppm)		0.5	0. 077	Alexandria

Notes:

a - Source: 40 CFR 50.1-50.12.

b - Source: VDEQ, 2005; 2006b.

c - Not to be exceeded more than once per year.

d - The 3-year average of the fourth highest daily maximum 8-hour average O_3 concentrations over each year must not exceed 0.08 ppm.

e- The 3-year average of the weighted annual mean $PM_{2.5}$ concentrations from must not exceed 15.0 ug/m^3.

f- The 3-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor must not exceed 65 ug/m^3.

g - The 3-year average of the weighted annual mean PM_{10} concentration at each monitor within an area must not exceed 50 ug/m^3.

ppm = parts per million

$\mu g/m^3$ = micrograms per cubic meter

NO_2 = Nitrogen dioxide

4.4.1.5 Mobile Sources

Main Post, EPG, and the GSA Parcel. Mobile sources of concern include primarily automobiles and vehicular traffic. The primary air pollutants from mobile sources are CO, NOx, and VOCs. Lead emissions from mobile sources have declined in recent years through the increased use of unleaded gasoline and are extremely small. Potential SO_2 and particulate emissions from mobile sources are small compared to emissions from point sources, such as power plants and industrial facilities. Although, emissions of SO_2 and particulates are relatively small, they have been included in a more detailed analysis. Air quality effects from traffic are generally evaluated on two scales.

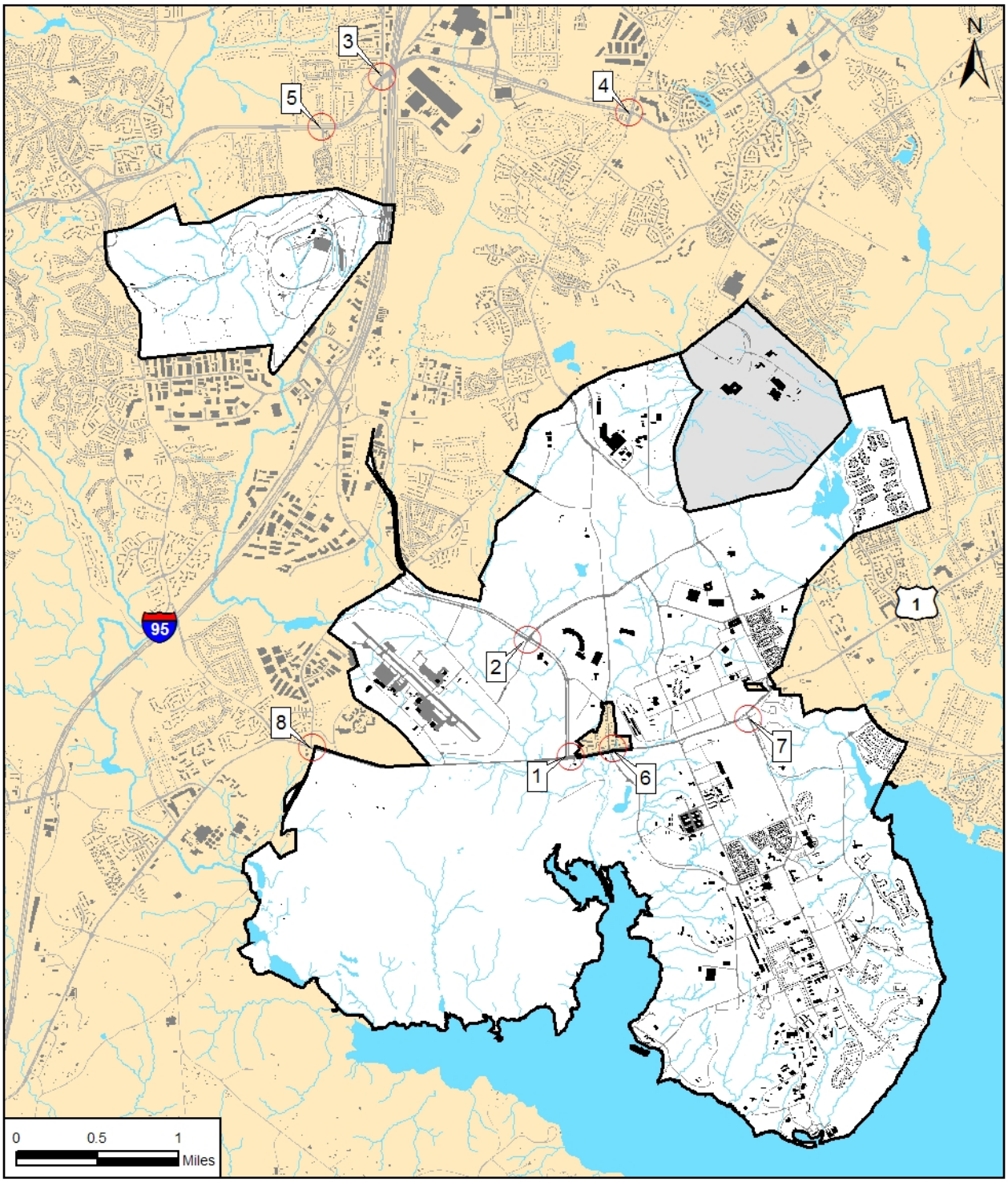
Meso-scale—Meso-scale analysis is performed at the regional level. Potential emission increases from additional vehicle miles traveled (VMT) resulting from an action could affect regional O_3 and/or $PM_{2.5}$ levels. However, because these are problems of regional concern and subject to air transport phenomena under different weather conditions, regional effects are generally evaluated by the Metropolitan Planning Organization (MPO) using regional airshed model(s). Meso-scale analysis is generally not conducted on a project-specific basis and is not necessary for this EIS.

Microscale—CO is a site-specific pollutant with higher concentrations found adjacent to roadways and signalized intersections. Microscale analysis is performed to identify localized *hot spots* of criteria pollutants at the intersection level. Microscale analysis is often conducted on an intersection-specific basis, and this approach was conducted for this EIS. Existing CO concentrations were estimated for receptor locations during weekday worst-case peak periods at the following eight intersections. The locations are generally shown on Figure 4.4-1.

- Route 1 and Fairfax County Parkway
- Fairfax County Parkway and John J. Kingman Road
- Franconia Springfield Parkway EB Ramp and Backlick Road
- Franconia Springfield Parkway and Beulah Street
- Franconia Springfield Parkway and Spring Village Drive
- Route 1 and Backlick Road–Pohick Road
- Route 1 and Belvoir Road
- Route 1 and Telegraph Road–Old Colchester Road

These intersections were selected on the basis of their existing traffic conditions and potential for maximum increase in traffic volumes and congestion associated with implementing the proposed action and alternatives. Individual intersections were examined based on traffic conditions on the associated roadways. Beyond the immediate area surrounding the intersections, CO emissions are anticipated to decrease. CO concentration levels at the other intersections of the study area are expected to be comparatively lower. Modeled CO levels under existing conditions at the study intersections with an unacceptable Level of Service (LOS) are shown in Table 4.4-3. The modeled CO levels show no existing violations of the NAAQS for any of the modeled intersections. Appendix E.2 describes CO modeling procedures and detailed results.

The traffic from these intersections is not anticipated to be an air quality concern for PM particulate matter because it does not involve new highways and expressways, and the intersections affected are primarily secondary arterial roads. Although in a $PM_{2.5}$ nonattainment



LEGEND

Installation Property

Approximate Air Quality Monitoring Station Location

CO Modeling Intersections

Fort Belvoir, Virginia

Sources: Fort Belvoir GIS, 2006; Fairfax County GIS, 2006.

Figure 4.4-1

Table 4.4-3
Existing peak hour CO levels

Intersection	Maximum 1-hour CO concentration (ppm)[a]	1-Hour NAAQS for CO (ppm)	Maximum 8-Hour CO concentration (ppm)[a]	8-Hour NAAQS for CO (ppm)	Exceeds NAAQS? (Yes/No)
Route 1/Fairfax County Parkway	5.8	35.0	4.1	9.0	No
Fairfax County Parkway/ John J. Kingman Road	6.6	35.0	4.6	9.0	No
Franconia Springfield Parkway EB Ramp/Backlick Road	7.6	35.0	5.3	9.0	No
Franconia Springfield Parkway/ Beulah Street	6.7	35.0	4.7	9.0	No
Franconia Springfield Parkway/ Spring Village Drive	6.2	35.0	4.3	9.0	No
Route 1/Backlick Road–Pohick Road	5.2	35.0	3.6	9.0	No
Route 1/Belvoir Road	5.0	35.0	3.5	9.0	No
Route 1/Telegraph Road–Old Colchester Road	6.2	35.0	4.3	9.0	No

Source: 40 CFR 50.1-50.12.

[a] CO levels include background concentrations of 3.7 ppm 1-hour and 2.5 ppm 8-hour (VDEQ, 2005a)

area, quantitative procedures to address $PM_{2.5}$ hot spot analysis have not yet been standardized and it is not standard practice to conduct such analysis for nontransportation projects, therefore such analysis is not included in this EIS (USEPA, 2006c).

In addition, Mobile Source Air Toxics (MSATs) are a subset of the 188 air toxics defined by the CAA. The MSATs are compounds emitted from highway vehicles and non-road equipment. Some toxic compounds are present in fuel and are emitted to the air when the fuel evaporates or passes through the engine unburned. Other toxics are emitted from the incomplete combustion of fuels or as secondary combustion products. As with particulate matter, traffic from these intersections is not anticipated to be an air quality concern for MAST because the intersections affected are primarily secondary arterial roads. Quantitative procedures to conduct MSAT analysis have not yet been standardized and is not standard practice for nontransportation projects on secondary arterials; therefore such analysis is not included in this EIS (FHWA, 2006).

4.4.1.6 Stationary Sources and Permitting Requirements

VDEQ oversees programs for permitting the construction and operation of new or modified stationary source air emissions in Virginia. Virginia air permitting is required for many industries and facilities that emit regulated pollutants. On the basis of the size of the emission units and type of pollutants emitted (criteria pollutants or hazardous air pollutants [HAPs]), VDEQ sets permit rules and standards for emission sources.

Construction Permits. The air quality permitting process begins with the application for a construction permit. There are three types of construction permits available through the VDEQ for the construction and temporary operation of new emission sources: Major New or Modified Source Construction Permits in Nonattainment Areas (Nonattainment New Source Review

(NNSR)); Prevention of Significant Deterioration (PSD) permits; and Minor New, Modified, and Certain Major Source Construction Permits (Minor NSR). NNSR and PSD permits are both part of the VDEQ Major NSR program. Thresholds that determine the type of construction permit that may be required depend on the emissions (both quantity and type) and if the permitted source is a new source or a modification to an existing source. Thresholds requiring either an NNSR or a PSD permit in Fairfax County are outlined in Table 4.4-4. For sources whose emissions are less than these threshold values, a Minor NSR permit would be required.

Nonattainment New Source Review. Major New or Modified Source Construction Permits in Nonattainment Areas (or Nonattainment New Source Review (NNSR) Permit) are required for any major new sources or major modifications to existing sources intended to be constructed in an area designated as nonattainment. NNSR permits are legal documents that specify what construction is allowed; what emission limits must be met; reporting, recordkeeping, and monitoring requirements; and often how the source must be operated. The NNSR permitting process typically takes 18–24 months. Specifically typical requirements for a NNSR permit may include

- Best Available Control Technology (BACT) review for qualifying attainment criteria pollutants
- Lowest Achievable Emission Rate (LAER) review for qualifying nonattainment pollutants (VOC, NO_x and $PM_{2.5}$)
- Maximum Achievable Control Technology (MACT) review for HAPs
- Air quality analysis (predictive air dispersion modeling)
- Acquiring emission offsets at a 1:1 or greater ratio for all contemporaneous emission increases that have occurred or are expected to occur on the Main Post, or for all new permits sources of emissions at EPG
- A public involvement process.

- **Prevention of Significant Deterioration (PSD).** The PSD program preserves the air quality in attainment areas. PSD regulations impose limits on the amount of pollutants

Table 4.4-4
Major thresholds of pollutants regulated under the CAA within Fairfax County

	New major source (tpy)		Major modification to an existing source[a] (tpy)	
Pollutant	**PSD[b]**	**NNSR**	**PSD**	**NNSR**
Carbon monoxide	250		100	
Nitrogen oxides		100		40
Sulfur dioxide	250		40	
Particulate matter	250		25	
PM_{10}	250		15	
$PM_{2.5}$		100		10
VOCs		50		40
Lead	250		0.6	

Source: VAC 5-20-204, 9 VAC 5-80-2010, and 40 CFR 52.21 (b) (23) (i)

Notes:

a – Represents the project emission increase considered 'significant'.

b – Applies to sources not listed in 40 CFR 52.21 (b) (1) (i) (a).

- that major sources may emit. The PSD process would apply to all pollutants for which the region is in attainment (all but O_3 and $PM_{2.5}$). The PSD permitting process typically takes 18–24 months to complete. Sources subject to PSD are typically required to complete the following:
  - BACT review for criteria pollutants
  - extensive predictive modeling of emissions from proposed and existing sources
  - extensive public involvement
- **Minor New Source Review.** A Minor New, Modified, and certain Major Source Construction Permit (or Minor NSR permit) would be required to construct minor new sources, minor modifications of existing sources, and major sources not subject to NNSR or PSD permit requirements. The Minor NSR permitting process typically takes 6–10 months to complete. Sources subject to Minor NSR may be required to complete the following:
  - BACT review for each criteria pollutant
  - MACT review for regulated HAPs and designated categories
  - air quality analysis (predictive air dispersion modeling), upon VDEQ's request
  - establish procedures for measuring and recording emissions and/or process rates

Operation Permits. Operating Permit applications are typically required within one year of operation of the sources. State Operating Permits are available through VDEQ. A Federal Operating Permit (Title V) may be required if a source is determined to be a major source.

- **State Operating Permits.** State Operating Permits are elective and may be used to obtain federally enforceable limits on criteria pollutants and HAPs below applicable major source thresholds. These "synthetic minor" sources would designate a stationary source or emission unit as a synthetic minor or area stationary source and thus be exempt from major source permitting requirements. State Operating Permits are also used to combine stationary source or emissions unit requirements under multiple permits into one permit.
- **Federal Operating Permit (Title V).** A Title V permit would be required for major sources of criteria pollutants as defined at 40 CFR Part 70. Title V permits would be required if the annual potential to emit exceeds thresholds for criteria and HAPs. The attainment status in each AQCR determines the major source threshold criteria. Fairfax County is a nonattainment area for $PM_{2.5}$, moderate nonattainment area for O_3, and within the O_3 transport region. The Title V major source thresholds for pollutant emissions are the same as the NNSR thresholds for major new sources and major modifications outlined in table 4.4-4.

Other Regulatory Requirements. In addition to the permitting requirements to construct and operate new or modified emission sources, New Source Performance Standards (NSPS) and the National Emission Standards for HAPs (NESHAPs) set emission control standards for categories of new stationary emission sources of both criteria pollutants and HAPs.

The NSPS process requires EPA to list categories of stationary sources that cause or contribute to air pollution that may reasonably be anticipated to endanger public health or welfare. The NSPS program sets uniform emission limitations for many industrial sources. As of July 11, 2005, stationary diesel engines are subject to NSPS. Applicability to the NSPS is based on engine size

and date of purchase and construction. Limitations on emissions come into effect using a tiered approach over time. Boilers with a maximum heat input of 10 million British thermal units (BTUs) or greater would be required to comply with NSPS.

The CAA Amendments of 1990, under revisions to section 112, required EPA to list and promulgate NESHAPs to reduce the emissions of HAPs, such as formaldehyde, benzene, xylene, and toluene from categories of major and area sources (40 CFR Part 63). New stationary sources whose potential to emit HAPs exceeds either 10 tpy of a single HAP, or 25 tpy of all regulated HAPs would be subject to MACT requirements.

Virginia's Administrative Code (9 VAC 5-40-90 and 9 VAC 5-50-90) requires reasonable precautions to prevent particulate matter from becoming airborne. Such precautions may include, but would not be limited to the following:

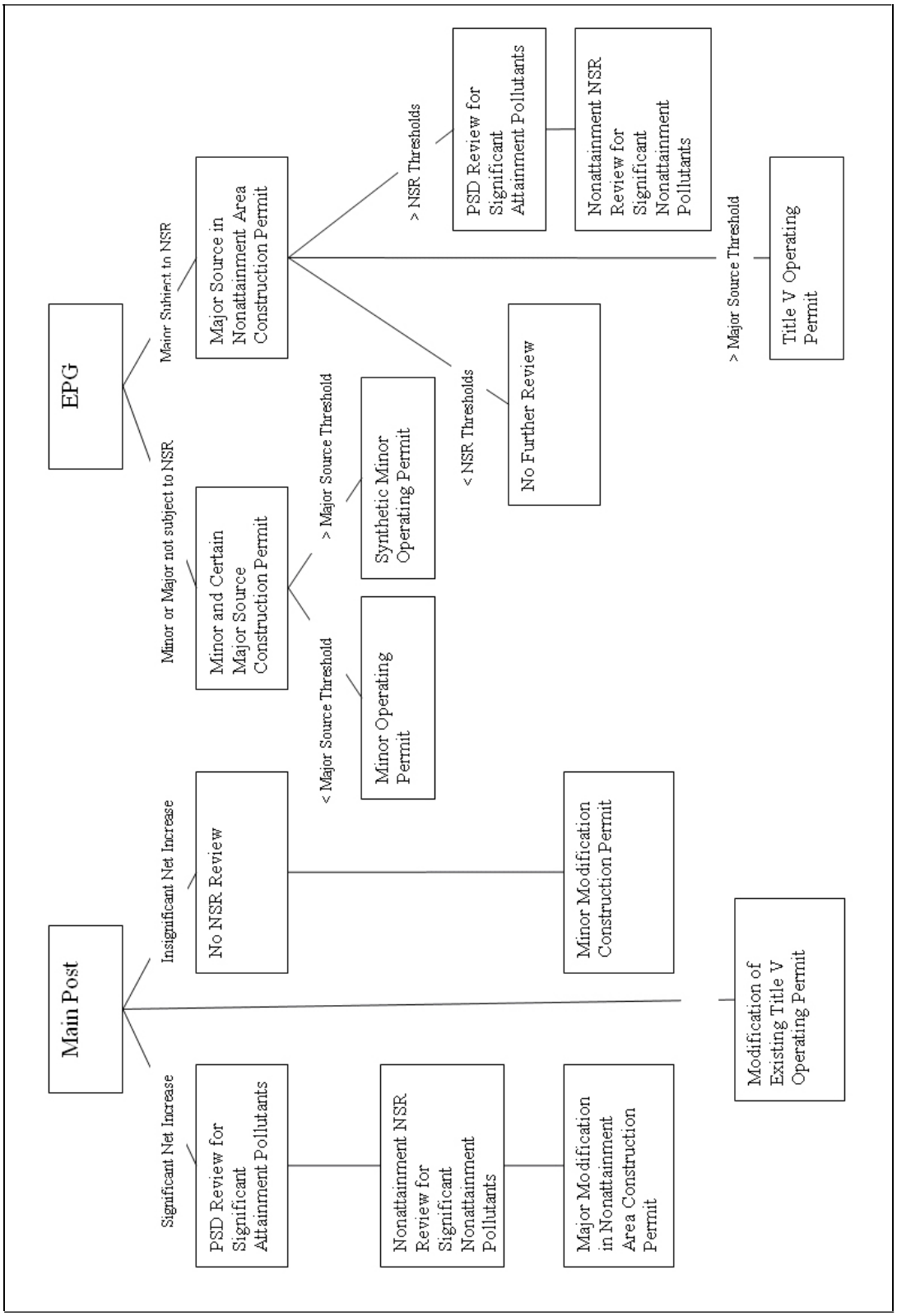
- Using water or chemicals for control of dust in the demolition of existing buildings or structures, construction operations, the grading of roads, or the clearing of land
- Applying water, or suitable chemicals on dirt roads, materials stockpiles, and other surfaces that might create airborne dust
- Paving roadways and maintaining them in a clean condition
- Installing and using hoods, fans, and fabric filters to enclose and vent the handling of dusty material, including the implementation of adequate containment methods during sandblasting or other similar operations
- Covering open equipment for conveying or transporting material likely to create objectionable air pollution when airborne
- Promptly removing spilled or tracked dirt or other materials from paved streets.

Main Post. On the basis of the installation's potential to emit, Fort Belvoir is a major source. Stationary sources of air emissions at Fort Belvoir include boilers, generators, incinerators, degreasers, and gasoline dispensers. An installation wide Title V permit was issued on March 24, 2003 (VDEQ, 2004). As part of the Title V permit requirements, the installation must submit a comprehensive emission statement annually. Table 4.4-5 summarizes 2005 on-post emissions from stationary sources. NNSR or PSD preconstruction permitting would be required if the thresholds for major modifications outlined in Table 4.4-4 were exceeded. Modification to the existing Title V permit will be required under any modification scenario. Figure 4.4-2 highlights the possible permitting scenarios for both the Main Post and EPG.

Table 4.4-5
2005 emissions from significant stationary sources at Fort Belvoir (tpy)

SO_2	CO	PM_{10}	$PM_{2.5}$	NOx	VOC	Total HAP
35.79	24.43	2.82	2.71	60.48	2.97	0.048

Source: Fort Belvoir, 2006a.



Potential Air Quality Permitting Scenarios

Figure 4.4-2

EPG and the GSA Parcel. There are no permitted stationary sources of air emissions at EPG or the GSA Parcel. An NNSR or PSD preconstruction permitting and eventually a Title V operating permit would be required if thresholds for a major new source outlined in Table 4.4-4 were exceeded.

4.4.2 ENVIRONMENTAL CONSEQUENCES OF THE PREFERRED ALTERNATIVE

Implementing the Preferred Alternative would be expected to have both short-term and long-term minor adverse effects to air quality. However, minor increases in emissions would conform to the SIP, would not introduce localized CO concentrations greater than the NAAQS, nor be expected to contribute to a violation of any federal, state, or local air regulations.

4.4.2.1 Land Use Plan Update

The planning activities associated with the land use plan update under this Alternative would not generate any direct or indirect air emissions. Therefore, updating the land use plan designations (comparison of 1993 land use [Figure 2-1] versus proposed [Figure 2-2]) would have no effect on the air quality. A detailed analysis is presented in the next section on BRAC implementation and potential effects associated these activities.

4.4.2.2 BRAC Implementation and Facilities Projects

Implementing the BRAC and other facilities projects could affect air quality in three ways: by generating pollutants during construction; by introducing new stationary sources of pollutants, such as heating boilers and standby generators; and through changes in vehicular traffic that could raise vehicle emission levels locally and possibly regionally. Air quality effects would be considered minor unless the estimated emissions would not conform to the SIP; contribute to a violation of any federal, state, or local air regulations; or introduce localized CO concentrations greater than the NAAQS.

4.4.2.2.1 General Conformity

The Draft GCD (Appendix E.1) demonstrates that the emissions associated with the Preferred Alternative conform to the purpose and intent of the applicable SIP. Therefore, by definition they do not interfere with the region's ability to attain the NAAQS in a timely fashion. The following summarizes the methodologies used to evaluate the applicability of the General Conformity Rule (GCR), and the results of the conformity evaluation.

The GCR requires the federal agency to consider net emissions generated from all direct and indirect sources of air emission that are reasonably foreseeable be considered. Direct emissions are emissions that would be caused or initiated by a federal action and occur at the same time and place as the action. Indirect emissions are defined as reasonably foreseeable emissions that would be caused by the action, but may occur later in time or be farther removed in distance from the action itself, and the federal agency can practicably control. For the evaluation of the Fort Belvoir realignment, direct emissions subject to the GCR are considered emissions from construction activities, motor vehicles, and point sources that would not be large enough to be subject to the Non-attainment New Source Review permitting process. Permits for minor stationary and area sources under Virginia's new minor source review program are not exempt from analysis under the regulations. However, to issue such a permit, the state must determine that the emissions are in conformity with the SIP and thus, an operator can generally rely on the permit as evidence of a determination and documentation that the emissions are included in the

SIP (USEPA, 2002a). Because both EPG and the Main Post are within the NCR, the emissions at both locations subject to the GCD have been combined throughout this discussion. More specifically, project-related direct and indirect emissions would result from the following:

- **Demolition and construction activities—**use of construction equipment, worker vehicles (e.g., bulldozers, backhoes), using use of VOC paints, paving off gasses, and fugitive particles from surface disturbances
- **Operational activities**— emergency generators, small heating boilers, and use of private motor vehicles

Demolition and construction emission associated with using construction equipment (e.g., bulldozers, backhoes), worker vehicles, using VOC paints, paving off gasses, and fugitive particles from surface disturbances are tabulated below for all the years of construction (Table 4.4-6).

Table 4.4-6
Estimated construction emissions

	Construction emissions (tpy)			
Year	**NO_x**	**VOC**	**$PM_{2.5}$**	**SO_2**
2007	129	76	99	19
2008	323	188	21	48
2009	329	215	20	52
2010	374	238	25	63
2011	130	69	13	24

2007 Annual construction emissions				
Construction activity	**NO_x**	**VOC**	**$PM_{2.5}$**	**SO_2**
Heavy equipment emissions	128	12	8	19
Worker trip emissions	1	1	0	0
Architectural coating emissions	0	63	0	0
Paving off-gas emissions	0	0	0	0
Fugitive dust emissions	0	0	1	0
Total	129	76	9	19

2008 Annual construction emissions				
Construction activity	**NO_x**	**VOC**	**$PM_{2.5}$**	**SO_2**
Heavy equipment emissions	318	29	20	48
Worker trip emissions	5	4	0	0
Architectural coating emissions	0	155	0	0
Paving off-gas emissions	0	0	0	0
Fugitive dust emissions	0	0	1	0
Total	323	188	21	48

2009 Annual construction emissions				
Construction activity	**NO_x**	**VOC**	**$PM_{2.5}$**	**SO_2**
Heavy equipment emissions	323	29	20	52
Worker trip emissions	6	5	0	0
Architectural coating emissions	0	181	0	0
Paving off-gas emissions	0	0	0	0
Fugitive dust emissions	0	0	0	0
Total	329	215	20	52

Table 4.4-6
Estimated construction emissions *(continued)*

	Construction emissions (tpy)			
	NO_x	VOC	$PM_{2.5}$	SO_2
2010 Annual construction emissions				
Construction activity	**NO_x**	**VOC**	**$PM_{2.5}$**	**SO_2**
Heavy equipment emissions	368	32	24	63
Worker trip emissions	6	6	0	0
Architectural coating emissions	0	200	0	0
Paving off-gas emissions	0	0	0	0
Fugitive dust emissions	0	0	1	0
Total	374	238	25	63
2011 Annual construction emissions				
Construction activity	**NO_x**	**VOC**	**$PM_{2.5}$**	**SO_2**
Heavy equipment emissions	128	11	12	24
Worker trip emissions	2	2	0	0
Architectural coating emissions	0	56	0	0
Paving off off-gas emissions	0		0	0
Fugitive dust emissions	0	0	1	0
Total	130	69	13	24

Appendix E.1 outlines the calculations and assumptions made to derive the construction emission estimations.

With respect to proposed Fort Belvoir BRAC action, project-related emissions would be those emissions that would occur with the action (build) when compared to the emissions that would occur without the action (no-build) (the net change in emission level). Table 4.4-7 presents the estimated increase in emissions with the proposed Fort Belvoir BRAC action, respectively (the project-related emissions). Notably, the net emissions would be slightly less than the overall construction emission because of the reduction in on-road vehicle emissions.

Table 4.4-7
Estimated total annual emissions subject to the general conformity rule from the 2005 realignment of Fort Belvoir

	Annual emissions (tpy)			
Year	**NO_x**	**VOC**	**$PM_{2.5}$**	**SO_2**
2007	129.2	76.0	9.5	18.5
2008	318.9	183.6	20.5	48.3
2009	320.9	206.7	20.4	51.7
2010	364.5	224.7	25.3	62.7
2011	119.5	53.8	12.8	23.2
2012 (and after)	–11.6	–16.2	–0.3	–0.5

Sources: USEPA NONROAD, 2005; SQAQMD, 1993; USEPA, 2002a; MOBILE6.2, USEPA AP-42; and DOE, 1999

Applicability. EPA established levels to exclude federal actions from the requirements to provide a GCD and would not impede an area's ability to attain the NAAQS. The applicability levels for O_3 and $PM_{2.5}$ within the Metropolitan Washington region were compared to the greatest annual project related emissions (Table 4.4-8). In addition, action (project)-related emissions are determined to be regionally significant if the emission level represents 10 percent or more of the regional total of emissions for which the area is nonattainment.

Table 4.4-8
Applicability thresholds applicable to the National Capital Interstate Air Quality Control Region

Criteria pollutants	Greatest annual project related emissions	Applicability threshold (tpy)	Exceeds applicability threshold (yes/no)
O_3 (NO_x or VOCs)			
Marginal and moderate NAAs inside an O_3 transport region			
VOC	224.7	50	Yes
NO_x	364.5	100	Yes
$PM_{2.5}$ ($PM_{2.5}$, NOx, SO_2)			
$PM_{2.5}$	25.3	100	No
NO_x	364.5	100	Yes
SO_2	62.7	100	No

Sources: 40 CFR 93.153; USEPA, 2006c

Notes:

tpy = tons per year

NAA = nonattainment area

Because the total of direct and indirect emissions of NO_x and VOC exceed the respective general conformity applicability thresholds, the general conformity requirements apply to these pollutants. As such, a formal conformity determination is required, and these pollutants were carried forward for detailed analysis. Notably, because the project-related emissions of these pollutants exceed the applicability thresholds, performing the regional significance applicability test would be redundant.

The total of direct and indirect emissions of $PM_{2.5}$ and of SO_2 is less than the applicability thresholds. Pending the full implementation of the $PM_{2.5}$ NAAQS, there is no current regional emission budget for $PM_{2.5}$ or SO_2. However, because of the limited size and scope of the proposed action when compared to the overall regional activity, it is not anticipated that emissions of $PM_{2.5}$ or SO_2 would be regionally significant. Therefore, the general conformity requirements do not apply, and there will be no further evaluation of these pollutants.

Construction Activity. The construction emission budgets in the currently approved 1-hour SIP or the draft 8-hour SIP does not identify specific or individual projects with respect to emissions resulting from regional construction activity. As such, the BRAC related emission estimates were compared to SIP-based projected emissions for the region for this type of activity to determine if the emissions could reasonably be accounted for in the regional totals. On the basis of the results of the comparison, the greatest level of construction-related VOC and NO_x emissions would represent approximately 0.7 and 1.9 percent of the VDEQ's regional emissions, respectively

(Table 4.4-9). Because the project-related construction emissions would represent a relatively small percentage of the regional projections, the Army, in consultation with VDEQ, determined that it is reasonable to assume that the construction emissions can be accounted for in the inventories for the 1-hour O_3 attainment demonstration SIP (40 CFR 93.158(a)(5)). Notably, the regional inventory for nonroad sources was used for the NO_x comparison because of the overwhelming contribution of these sources to the project related emissions of NO_x. In addition, the regional inventory for area sources was used for the VOC comparison because of the overwhelming contribution of architectural coatings and paving off gasses to the project related emissions of VOCs. The Draft General Conformity Determination and supporting emission estimations are provided in Appendix E.1.

Table 4.4-9
Comparison of 2010 project-related emissions and SIP-based inventories - construction activities

Pollutant	SIP regional emission inventory (tons/summer weekday)	Project-related non-road emissions (tons/summer weekday)	Percent of regional emissions
Approved 1-hour SIP			
Nitrogen oxides (NO_x)	82.8[a]	1.58	1.9%
Volatile organic compounds (VOCs)	147.3[b]	0.98	0.7%
Draft 8-hour SIP			
Nitrogen oxides (NO_x)	76.9[c]	1.58	2.1%
Volatile organic compounds (VOCs)	191.8[d]	0.98	0.5%

Source: MWCOG, 2004a.
[a] Reflects 2005 nonroad controlled NOx emissions inventory
[b] Reflect 2005 area controlled VOC emissions inventory
[c] Reflects 2009 nonroad controlled NOx emissions inventory
[d] Reflect 2009 area controlled VOC emissions inventory

Motor Vehicles. The realignment of Fort Belvoir would decrease both the number of vehicles and subsequently the total vehicle miles traveled within the region. In turn, regional motor vehicle emissions would decrease. This decrease would be primarily because of a net reduction of approximately 1,700 personnel leaving Fort Belvoir to locations outside the region. Although overall additional personnel at Fort Belvoir is expected to increase, the new personnel and the miles they currently commute are already with in the NCR. In addition, many of the new personnel are expected to either relocated to or be replaced by individuals living in areas outside, primarily south of, the region. These BRAC-related reductions in emissions would constitute an ongoing net benefit to the region's air quality. Therefore, although there is an SIP-based regional budget for motor vehicles, it was unnecessary to perform a direct comparison.

In accordance with Section 176 of the CAA, the Army has assessed whether pollutant and pollutant precursor emissions that would result from the Army's actions with respect to the proposed base realignment at Fort Belvoir would conform to the SIP. The emission estimates for the GCD were prepared

- Using the latest planning assumptions
- Using the latest and most accurate emission estimation techniques

- According to the applicable air quality models, databases, and other requirements specified in the most recent version of the EPA's *Guideline on Air Quality Models*, including supplements.

On the basis of the results of the evaluation, the total direct and indirect project-related emissions of NO_x, VOCs, $PM_{2.5}$, and SO_2 and were determined to be any one of the following:

- Less than the applicability thresholds
- Accounted for in the emission projections incorporated into the 1-hour O_3 attainment demonstration SIP (the applicable SIP)
- Could reasonably be accounted for in established emission totals and or excess regional emission estimates.

A detailed discussion and the formal conformity analysis and determination are located in Appendix E.

4.4.2.2.2 Transportation Emissions and Localized CO Concentrations

Implementing the Preferred Alternative and the realignment of Fort Belvoir would decrease both the number of vehicles and the total VMT within the region. In turn, regional motor vehicle emissions would decrease. This decrease would be primarily because of a net reduction of approximately 1,700 personnel from the region and a slight overall decrease in VMT by individuals remaining. These BRAC-related reductions in emissions would constitute an ongoing net benefit to the region's air quality.

However, increases in localized traffic near the installation would result in an increase in traffic congestion and subsequent long-term minor increases in localized CO concentrations at nearby intersections (Table 4.4-10). These minor increases would not contribute to a violation of the CO NAAQS. The traffic changes associated with the Preferred Alternative would not be expected to cause significant long-term increases of other criteria pollutants, such as O_3, Pb, SO_2, VOCs, and NO_x. Detailed methodology for the determination of localized CO concentrations at intersections of interest is provided in Appendix E.2.

4.4.2.2.3 Regulatory Review and Air Permit Requirements

The new facilities would be equipped with several natural gas boilers and emergency generators. No other stationary sources of air emissions would be anticipated. The estimated potential emissions from proposed new sources for Fort Belvoir Main Post and EPG under the Preferred Land Use Alternative are outlined in Table 4.4.11. The supporting emission estimations are provided in Appendix E.3.

Main Post. All projects sited on Main Post are anticipated to have stationary source emission levels below the threshold that constitutes a major modification. However minor NSR construction permits may be required for some of the projects. A modification to Fort Belvoir's existing Title V permit would also be anticipated under this alternative. All new stationary sources would meet the NSPS and NESHAP requirements.

EPG and the GSA Parcel. The Army intends to limit the potential emissions of the stationary sources installed at EPG through federally enforceable limits to less than the major new source threshold. The Army anticipates that a minor NSR construction permit will be needed. All new stationary sources would meet the NSPS and NESHAP requirements.

Table 4.4-10
Peak hour CO levels under the Preferred Alternative

Intersection	Maximum 1-hour CO concentration (ppm)[a]	1-Hour NAAQS for CO (ppm)	Maximum 8-hour CO concentration (ppm)[a]	8-Hour NAAQS for CO (ppm)	Exceeds NAAQS? (Yes/No)
Fairfax County Parkway/John J. Kingman Road	6.8	35.0	4.8	9.0	No
Franconia Springfield Parkway EB Ramp/ Backlick Road	7.6	35.0	5.3	9.0	No
Franconia Springfield Parkway/Beulah Street	6.8	35.0	4.8	9.0	No
Franconia Springfield Parkway/Spring Village Drive	7.3	35.0	5.1	9.0	No
Route 1/Backlick Road–Pohick Road	6.0	35.0	4.2	9.0	No
Route 1/Belvoir Road	5.7	35.0	4.0	9.0	No
Route 1/Fairfax County Parkway	6.2	35.0	4.3	9.0	No
Route 1/ Telegraph Road–Old Colchester Road	6.9	35.0	4.8	9.0	No

Source: 40 CFR 50.1-50.12

[a] CO levels include background concentrations of 3.7 ppm 1-hour and 2.5 ppm 8-hour (VDEQ, 2005a)

Table 4.4-11
Estimated potential emissions for stationary sources for the Preferred Alternative

	Potential to emit (tpy)				
	CO	NO_x	$PM/PM_{10}/PM_{2.5}$	SO_2	VOC
Main Post—proposed new sources	3	38	1	1	2
EPG Roll-up	39	73	15	11	4

Sources: AP-42, DOE 1999

4.4.2.3 BMPs/Mitigation

BMPs. BMPs would be required and implemented for both construction emissions and stationary point source emission associated with this alternative. BMPs to control fugitive particle emissions implemented during construction may include:

- Using water or chemicals for control of dust in the demolition of existing buildings or structures, construction operations, the grading of roads, or the clearing of land
- Applying water, or suitable chemicals on dirt roads, materials stockpiles, and other surfaces that might create airborne dust
- Paving roadways and maintaining them in a clean condition
- Installing and using hoods, fans, and fabric filters to enclose and vent the handling of dusty material, including the implementation of adequate containment methods during sandblasting or other similar operations
- Covering open equipment for conveying or transporting material likely to create objectionable air pollution when airborne

- Promptly removing spilled or tracked dirt or other materials from paved streets

BMPs associated with the new permitted stationary sources of emissions would include:

- BACT review for each criteria pollutant
- MACT review for regulated HAPs and designated categories
- Air quality analysis (predictive air dispersion modeling), upon VDEQ's request
- Establishing procedures for measuring and recording emissions and/or process rates
- Meeting the NSPS and NESHAP requirements.

Mitigation. No specific mitigation measures with respect to air quality would be required with the implementation of the Preferred Alternative.

4.4.3 ENVIRONMENTAL CONSEQUENCES OF THE TOWN CENTER ALTERNATIVE

Implementing the Town Center Use Plan Alternative would be expected to have both short-term and long-term minor adverse effects to air quality. However, minor increases in emissions would conform to the SIP, would not introduce localized CO concentrations greater than the NAAQS, and would not be expected to contribute to a violation of any federal, state, or local air regulations.

4.4.3.1 Land Use Plan Update

The planning activities associated with the land use plan update under this alternative would not generate any direct or indirect air emissions. Therefore, updating the land use plan designations would have no affect on the air quality. Detailed analysis is presented in the next section on BRAC implementation and potential effects associated these activities.

4.4.3.2 BRAC Implementation and Facilities Projects

Implementing the BRAC and other facilities projects under this alternative could affect air quality in three ways: by generating pollutants during construction; by introducing new stationary sources of pollutants, such as heating boilers and standby generators; and through changes in vehicular traffic that could raise vehicle emission levels locally and possibly regionally. Air quality effects would be considered minor unless the estimated emissions would not conform to the SIP, contribute to a violation of any federal, state, or local air regulations, or introduce localized CO concentrations greater than the NAAQS.

4.4.3.2.1 General Conformity

Regardless of alternative, all activities associated with the BRAC action that would generate emissions would be identical in magnitude and occur within the region. Variation in the siting of the new facilities on Fort Belvoir under the Town Center Alternative would not change the emission estimations, the applicability of the GCR, or the determination of conformity. For these reasons, the Army has determined that the emissions associated with the Town Center Alternative conform to the CAA, and by definition, would not significantly impede the timely attainment of the NAAQS in the NCR.

4.4.3.2.2 Transportation Emissions and Localized CO Concentrations

Implementing the Town Center Alternative and the realignment of Fort Belvoir would decrease both the number of vehicles and the total vehicle miles traveled within the region. In turn, regional motor vehicle emissions would decrease. This decrease would be primarily due to a net reduction of approximately 1,700 personnel from the region and a slight overall decrease in vehicle miles traveled by individuals remaining. These BRAC-related reductions in emissions would constitute an ongoing net benefit to the region's air quality.

However, similar to the previous alternative, increases in localized traffic near the installation would result in an increase in traffic congestion and subsequent long-term minor increases in localized CO concentrations at nearby intersections (Table 4.4-12). These minor increases would not contribute to a violation of the CO NAAQS. The traffic changes associated with the Town Center Alternative would not be expected to cause significant long-term increases of other criteria pollutants, such as O_3, Pb, SO_2, VOCs, and NO_x. Detailed methodology for the determination of localized CO concentrations at intersections of interest is provided in Appendix E.2.

Table 4.4-12
Peak hour CO levels under the Town Center Alternative

Intersection	Maximum 1-Hour CO concentration (ppm)[a]	1-Hour NAAQS for CO (ppm)	Maximum 8-Hour CO concentration (ppm)[a]	8-Hour NAAQS for CO (ppm)	Exceeds NAAQS? (Yes/No)
Fairfax County Parkway/John J. Kingman Road	7.0	35.0	4.9	9.0	No
Franconia Springfield Parkway/Beulah Street	6.8	35.0	4.8	9.0	No
Route 1/Backlick Road–Pohick Road	6.3	35.0	4.4	9.0	No
Route 1/Belvoir Road	5.4	35.0	3.8	9.0	No
Route 1/Fairfax County Parkway	6.6	35.0	4.6	9.0	No
Route 1/Telegraph Road–Old Colchester Road	6.8	35.0	4.8	9.0	No

Source: 40 CFR 50.1-50.12

[a] CO levels include background concentrations of 3.7 ppm 1-hour and 2.5 ppm 8-hour (VDEQ, 2005a)

4.4.3.2.3 Regulatory Review and Air Permit Requirements

The new facilities would be equipped with several natural gas boilers and emergency generators. No other stationary sources of air emissions would be anticipated. Estimated potential emissions from proposed new sources for the Fort Belvoir Main Post and EPG under the Town Center Alternative are outlined in Table 4.4-13.

Table 4.4-13
Estimated potential emissions for stationary sources for the Town Center Alternative

	Potential to emit (tpy)				
	CO	NO_x	$PM/PM_{10}/PM_{2.5}$	SO_2	VOC
Main Post	43	111	16	11	6
EPG	0	0	0	0	0

Sources: AP-42; DOE, 1999

Main Post. All projects sited on Main Post are anticipated to have stationary source emission levels below the threshold that constitutes a major modification. However minor NSR construction permits may be required for some of the projects. A modification to Fort Belvoir's existing Title V permit would also be anticipated under this alternative. All new stationary sources would meet the NSPS and NESHAP requirements.

EPG. Because no new sources of air emissions would be sited at EPG under the Town Center Alternative, no construction or operating permits would be required for these sites.

4.4.3.3 BMPs/Mitigation

BMPs. BMPs would be similar to those listed in Section 4.4.2.3.

Mitigation. No specific mitigation measures with respect to air quality would be required with the implementation of the Town Center Alternative.

4.4.4 ENVIRONMENTAL CONSEQUENCES OF THE CITY CENTER ALTERNATIVE

Implementing the City Center Use Plan Alternative would be expected to have both short-term and long-term minor adverse effects to air quality. However, minor increases in emissions would conform to the SIP, would not introduce localized CO concentrations greater than the NAAQS, and would not be expected to contribute to a violation of any federal, state, or local air regulations.

4.4.4.1 Land Use Plan Update

The planning activities associated with the land use plan update under this alternative would not generate any direct or indirect air emissions. Therefore, updating the land use plan designations would have no affect on the air quality. Detailed analysis is presented in the next section on BRAC implementation and potential effects associated these activities.

4.4.4.2 BRAC Implementation and Facilities Projects

Implementing the BRAC and other facilities projects under this alternative could affect air quality in three ways: through pollutants generated during construction; by introducing new stationary

sources of pollutants, such as heating boilers and standby generators; and through changes in vehicular traffic that could raise vehicle emission levels locally and possibly regionally. Air quality effects would be considered minor unless the estimated emissions would not conform to the SIP; contribute to a violation of any federal, state, or local air regulations; or introduce localized CO concentrations greater than the NAAQS.

4.4.4.2.1 General Conformity

Regardless of the alternative, all activities associated with the BRAC action that would generate direct and indirect emissions would be identical in magnitude and occur within the region. Variation in the siting of the new facilities on Fort Belvoir with the City Center Alternative would not change the emission estimations, the applicability of the GCR, or the determination of conformity. For these reasons, the Army has determined that the emissions associated with the City Center Alternative conform to the CAA, and by definition, would not significantly impede the timely attainment of the NAAQS in the NCR.

4.4.4.2.2 Transportation Emissions and Localized CO Concentrations

Implementing the City Center Alternative and the realignment of Fort Belvoir would decrease both the number of vehicles and the total vehicle miles traveled within the region. In turn, regional motor vehicle emissions would decrease. This decrease would be primarily due to a net reduction of approximately 1,700 personnel from the region and a slight overall decrease in vehicle miles traveled by individuals remaining. These BRAC-related reductions in emissions would constitute an ongoing net benefit to the region's air quality.

However, increases in localized traffic near the installation would result in an increase in traffic congestion and subsequent long-term minor increases in localized CO concentrations at nearby intersections (Table 4.4-14). These minor increases would not be expected to contribute to a violation of the CO NAAQS. The traffic changes associated with the Preferred Alternative would not cause significant long-term increases of other criteria pollutants, such as O_3, Pb, SO_2, VOCs, and NO_x. Detailed methodology for the determination of localized CO concentrations at intersections of interest is provided in Appendix E.2.

Table 4.4-14
Peak hour CO levels under the City Center Alternative

Intersection	Maximum 1-Hour CO concentration (ppm)[a]	1-Hour NAAQS for CO (ppm)	Maximum 8-Hour CO concentration (ppm)[a]	8-Hour NAAQS for CO (ppm)	Exceeds NAAQS? (Yes/No)
Fairfax County Parkway/John J. Kingman Road	6.7	35.0	4.7	9.0	No
Franconia Springfield Parkway EB Ramp/Backlick Road	7.6	35.0	5.3	9.0	No
Franconia Springfield Parkway/Beulah Street	6.8	35.0	4.8	9.0	No
Franconia Springfield Parkway/Spring Village Drive	7.3	35.0	5.1	9.0	No
Route 1/Backlick Road–Pohick Road	5.7	35.0	4.0	9.0	No
Route 1/Fairfax County Parkway	6.1	35.0	4.3	9.0	No
Route 1/Telegraph Road–Old Colchester Road	6.8	35.0	4.8	9.0	No

Source: 40 CFR 50.1-50.12

[a]CO levels include background concentrations of 3.7 ppm 1-hour and 2.5 ppm 8-hour (VDEQ, 2005a)

4.4.4.2.3 Regulatory Review and Air Permit Requirements

The new facilities would be equipped with several natural gas boilers and emergency generators. No other stationary sources of air emissions would be anticipated. Estimated potential emissions from proposed new sources for the Fort Belvoir Main Post and EPG under the City Center Alternative are outlined in Table 4.4-15.

Table 4.4-15
Estimated potential emissions for stationary sources for the City Center Alternative

	Potential to emit (tpy)				
	CO	NO_x	$PM/PM_{10}/PM_{2.5}$	SO_2	VOC
Main Post	1	2	0	0	0
EPG and GSA Parcel	43	109	16	11	6

Sources: AP-42; DOE, 1999

Main Post. All projects sited on Main Post are anticipated to have stationary source emission levels below the threshold that constitutes a major modification. However minor NSR construction permits may be required for some of the projects. A modification to Fort Belvoir's existing Title V permit would also be anticipated under this alternative. All new stationary sources would meet the NSPS and NESHAP requirements.

EPG and the GSA Parcel. EPG and the GSA Parcel areis discontiguous with respect to the Main Post; therefore, it meets the requirements of a separate facility. Exceedence of the major source thresholds would be anticipated with the implementation of the City Center Alternative. A NNSR permit would be required for these facilities. All new stationary sources would meet the NSPS and NESHAP requirements. Emission estimations were made using the current planning assumption on size and type of stationary sources.

4.4.4.3 BMPs/Mitigation

BMPs. BMPs would be similar to those listed in Section 4.4.2.3.

Mitigation. Mitigation with respect to air quality would be required with the implementation of the City Center Alternative. Under the NNSR permitting requirements, NO_x emission offsets at a ratio of 1:1.15 would have to be located and obtained for all stationary sources sited on EPG. Emission offsets are generally unavailable in this region and could be extremely expensive if they could be obtained at all.

4.4.5 ENVIRONMENTAL CONSEQUENCES OF THE SATELLITE CAMPUSES ALTERNATIVE

Implementing the Satellite Campuses Alternative would be expected to have both short-term and long-term minor adverse effects to air quality. However, minor increases in emissions would be expected to conform to the SIP, would not introduce localized CO concentrations greater than the NAAQS, and would not be expected to contribute to a violation of any federal, state, or local air regulations.

4.4.5.1 Land Use Plan Update

The planning activities associated with the land use plan update under this alternative would not be expected to generate any direct or indirect air emissions. Therefore, updating the land use plan designations would have no affect on the air quality. Detailed analysis is presented in the next section on BRAC implementation and potential effects associated these activities.

4.4.5.2 BRAC Implementation and Facilities Projects

Implementing the BRAC and other facilities projects under this alternative can affect air quality in three ways: by generating pollutants during construction; by introducing new stationary sources of pollutants, such as heating boilers and standby generators; and through changes in vehicular traffic that may raise vehicle emission levels locally and possibly regionally. Air quality effects would be considered minor unless the estimated emissions would not conform to the SIP; contribute to a violation of any federal, state, or local air regulations; or introduce localized CO concentrations greater than the NAAQS.

4.4.5.2.1 General Conformity

Regardless of the alternative, all activities associated with the BRAC action that would generate direct and indirect emissions would be identical in magnitude and occur within the same region. Variation in the siting of the new facilities on Fort Belvoir with the Satellite Campuses Alternative would not change the emission estimations, the applicability of the GCR, or the determination of conformity. For these reasons, the Army has determined that the emissions associated with the Satellite Campuses Alternative conform to the CAA and, by definition, would not significantly impede the timely attainment of the NAAQS in the NCR.

4.4.5.2.2 Transportation Emissions and Localized CO Concentrations

Implementing the Satellite Campuses Alternative and the realignment of Fort Belvoir would decrease both the number of vehicles and the total vehicle miles traveled within the region. In turn, regional motor vehicle emissions would decrease. This decrease would be primarily due to a net reduction of approximately 1,700 personnel from the region, and a slight overall decrease in vehicle miles traveled by individuals remaining. These BRAC-related reductions in emissions would constitute an ongoing net benefit to the region's air quality.

However, increases in localized traffic near the installation would result in an increase in traffic congestion and subsequent long-term minor increases in localized CO concentrations at nearby intersections (Table 4.4-16). These minor increases would not be expected to contribute to a violation of the CO NAAQS. The traffic changes associated with the Satellite Campuses Alternative would not be expected to cause significant long-term increases of other criteria pollutants, such as O_3, Pb, SO_2, VOCs, and NO_x. Detailed methodology for the determination of localized CO concentrations at intersections of interest is provided in Appendix E.2.

Table 4.4-16
Peak hour CO levels under the Satellite Campuses Alternative

Intersection	Maximum 1-Hour CO concentration (ppm)[a]	1-Hour NAAQS for CO (ppm)	Maximum 8-Hour CO concentration (ppm)[a]	8-Hour NAAQS for CO (ppm)	Exceeds NAAQS? (Yes/No)
Fairfax County Parkway/John J. Kingman Road	7.0	35.0	4.9	9.0	No
Franconia Springfield Parkway/Beulah Street	6.8	35.0	4.8	9.0	No
Route 1/Backlick Road–Pohick Road	6.1	35.0	4.3	9.0	No
Route 1/Fairfax County Parkway	6.4	35.0	4.5	9.0	No
Route 1/Telegraph Road–Old Colchester Road	6.8	35.0	4.8	9.0	No

Source: 40 CFR 50.1-50.12

[a]CO levels include background concentrations of 3.7 ppm 1-hour and 2.5 ppm 8-hour (VDEQ, 2005a)

4.4.5.2.3 Regulatory Review and Air Permit Requirements

The new facilities would be equipped with several natural gas boilers and emergency generators. No other stationary sources of air emissions would be anticipated. Estimated potential emissions from proposed new sources for Fort Belvoir Main Post and EPG under the Satellite Campuses Alternative are outlined in Table 4.4-17.

Main Post. All projects sited on Main Post are anticipated to have stationary source emission levels below the threshold that constitutes a major modification. However minor NSR

Table 4.4-17
Estimated potential emissions for stationary sources for the Satellite Campuses Alternative

	Potential to emit (tpy)				
	CO	NO_x	$PM/PM_{10}/PM_{2.5}$	SO_2	VOC
Main Post	43	111	16	11	6
EPG	0	0	0	0	0

Sources: AP-42, DOE 1999

construction permits may be required for some of the projects. A modification to Fort Belvoir's existing Title V permit would also be anticipated under this alternative. All new stationary sources would meet the NSPS and NESHAP requirements.

EPG. Because no new sources of air emissions would be sited at EPG under the Satellite Campuses Alternative, no construction or operating permits would be required for these sites.

4.4.5.3 BMPs/Mitigation

BMPs. BMPs would be similar to those listed in Section 4.4.2.3.

Mitigation. No specific mitigation measures with respect to air quality would be required with the implementation of the Satellite Campuses Alternative.

4.4.6 NO ACTION ALTERNATIVE

The No Action Alternative would not result in changes in ambient air quality conditions if the BRAC action at Fort Belvoir were not implemented. No BRAC-related construction activities would be undertaken, and no BRAC-related changes in operations or traffic would take place. A GCD for the action and the permitting of stationary sources would not be required. However, under the No Action Alternative, regional traffic growth would continue and there would be no net exodus of Fort Belvoir personnel from the region. Below is a description of the No Action Alternative as a comparative baseline—knowing that primarily vehicle emissions both locally and regionally would continue to change under the No Action Alternative.

4.4.6.1 Transportation Emissions and Localized CO Concentrations

The No Action Alternative would not decrease the number of vehicles and the overall total VMT within the region. In turn, regional motor vehicle emissions would increase due to the in situ growth without the proposed changes. The BRAC-related reductions in vehicle emissions, and their subsequent ongoing net benefit to the region's air quality, would not be realized under the No Action Alternative.

However, non-BRAC increases in localized traffic near the installation would result in an increase in traffic congestion and subsequent long-term minor increases in localized CO concentrations at nearby intersections (Table 4.4-18). These minor increases would not contribute to a violation of the CO NAAQS. The traffic changes associated with the No Action Alternative would not be expected to cause significant long-term increases of other criteria pollutants, such as O_3, Pb, SO_2, VOCs, and NO_x. Detailed methodology for the determination of localized CO concentrations at intersections of interest is provided in Appendix E.2.

Table 4.4-18
Peak hour CO levels under the No Action Alternative

Intersection	Maximum 1-Hour CO concentration (ppm)[a]	1-Hour NAAQS for CO (ppm)	Maximum 8-Hour CO concentration (ppm)[a]	8-Hour NAAQS for CO (ppm)	Exceeds NAAQS? (Yes/No)
Route 1/Fairfax County Parkway	5.9	35.0	4.1	9.0	No
Fairfax County Parkway/John J. Kingman Road	6.7	35.0	4.7	9.0	No
Franconia Springfield Parkway EB Ramp/ Backlick Road	7.6	35.0	5.3	9.0	No
Franconia Springfield Parkway/Beulah Street	7.0	35.0	4.9	9.0	No
Franconia Springfield Parkway/Spring Village Drive	6.7	35.0	4.7	9.0	No
Route 1/Backlick Road–Pohick Road	5.6	35.0	3.9	9.0	No
Route 1/Belvoir Road	5.0	35.0	3.5	9.0	No
Route 1/Telegraph Road–Old Colchester Road	6.6	35.0	4.6	9.0	No

Source: 40 CFR 50.1-50.12

[a]CO levels include background concentrations of 3.7 ppm 1-hour and 2.5 ppm 8-hour (VDEQ, 2005a)

4.4.7 SUMMARY OF COMPARISON OF ALTERNATIVES

For all the development alternatives, implementing the BRAC action would be expected to have both short-term and long-term minor adverse effects to air quality. However, minor increases in emissions would conform to the SIP; would not be expected to contribute to a violation of any federal, state, or local air regulations; or introduce localized CO concentrations greater than the NAAQS.

Regionally the alternatives are very similar. Each would constitute approximately the same amount of both construction and operating emissions within the region for all years. A Draft General Conformity Determination was prepared and demonstrates that the emissions associated with each of the alternatives conform to the purpose and intent of the applicable SIP. Therefore, by definition, they do NOT:

- Interfere with the region's ability to attain the NAAQS in a timely fashion
- Cause or contribute to any new violations of an NAAQS
- Increase the frequency or severity of any existing violation of any NAAQS
- Delay timely attainment of any NAAQS or any required interim emission reductions or other milestones.

For all the alternatives, both construction and operating permits for the new sources of air emission would be required for some of the new sources of air emissions. Implementation of some of the projects on Main Post under the Town Center or Satellite Campuses Alternatives could potentially exceed the major modification threshold. Emission resulting from the implementation of the City Center Alternative would exceed major source thresholds. For these alternatives, a Nonattainment New Source Review permit would may be required and emission offsets at a ration of 1:1.15 would have to be located and obtained for all stationary sources that fell under this permit.

For all the alternatives, implementing the BRAC action would decrease both the number of vehicles and the total VMT within the region. In turn, regional motor vehicle emissions would decrease. This decrease would be primarily due to a net reduction of approximately 1,700 personnel from the region. These are personnel leaving Fort Belvoir to areas outside the NCR. These BRAC-related reductions in emissions would constitute an ongoing net benefit to the region's air quality. However, increases in localized traffic near the installation would result in minor increase in traffic congestion and subsequent long-term minor increases in localized CO concentrations at nearby intersections. For all the alternatives, these minor increases would not be expected to contribute to a violation of the CO NAAQS. The traffic changes would not be expected to cause significant long-term increases of other criteria pollutants, such as O_3, Pb, SO_2, VOCs, and NO_x.

4.5 NOISE

4.5.1 AFFECTED ENVIRONMENT

4.5.1.1 Noise Fundamentals

Sound is a physical phenomenon consisting of minute vibrations that travel through a medium, such as air, and are sensed by the human ear. Noise is defined as any sound that is undesirable because it interferes with communication, is intense enough to damage hearing, or is otherwise intrusive. Human response to noise varies depending on the type and characteristics of the noise, distance between the noise source and the receptor, receptor sensitivity, and time of day. Noise is often generated by activities essential to a community's *quality of life*, such as construction or vehicular traffic.

Sound varies by both intensity and frequency. Sound pressure level (SPL), described in decibels (dB), is used to quantify sound intensity. The dB is a logarithmic unit that expresses the ratio of a sound pressure level to a standard reference level. Hertz (Hz) are use to quantify sound frequency. The human ear responds differently to different frequencies. *A-weighing*, described in a-weighted decibels (dBA), approximates this frequency response to express accurately the perception of sound by humans. Sounds encountered in daily life and their approximate level in dBA is provided in Table 4.5-1.

Table 4.5-1
Common sounds and their levels

Outdoor	Sound level (dBA)	Indoor
Jetcraft at 50 feet	110	
Snowmobile	100	Subway train
Tractor	90	Garbage disposal
Noisy restaurant	85	Blender
Downtown (large city)	80	Ringing telephone
Freeway traffic	70	TV audio
Normal conversation	60	Sewing machine
Rainfall	50	Refrigerator
Quiet residential area	40	Library

Source: Harris, 1998

The ability to perceive changes in noise levels varies widely from person to person, as do individuals' responses to perceived changes. In general, a three-dBA change in noise level is barely perceptible to most listeners. A ten-dBA change is normally perceived as a doubling (or halving) of noise levels and is considered a substantial change. These thresholds make it possible to estimate a person's probable perception of changes in noise levels (Table 4.5-2).

4.5.1.2 Traffic Noise

The dBA noise metric describes steady noise levels; however, very few noises are, in fact, constant. Therefore, a noise metric, equivalent sound level (L_{eq}), has been developed. L_{eq} represents the average sound energy over a given time period presented in dB(e.g., 1-hour L_{eq} [$L_{eq}(1)$]). The Federal Highway Administration (FHWA) and the Commonwealth of Virginia

Table 4.5-2
Perception of changes in noise levels

Change in dBA	Perception
3	Barely perceptible change
5	Readily perceptible change
10	Twice or half as loud
20	Four times or 1/4 as loud
40	Eight times or 1/8 as loud

Source: FHWA, 1995

Department of Transportation (VDOT) use the $L_{eq}(1)$ descriptor to estimate the degree of nuisance or annoyance arising from changes in traffic noise. Because the principal noise-related concern is traffic noise, the $L_{eq}(1)$ descriptor is used in this analysis.

FHWA has established noise abatement criteria (NAC) that define traffic-related noise thresholds. These NAC vary depending on the type of land use and provide a convenient benchmark to assess the level at which noise becomes a clear source of annoyance (Table 4.5-3). Category B, which represents moderately sensitive land uses, best describes areas surrounding the Main Post, EPG and the GSA Parcel. The NAC for category B is 67 dBA.

Table 4.5-3
FHWA noise-abatement criteria

Activity category	Description of activity category	NAC $L_{eq}(1)$
A	Land for which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose	57 (exterior)
B	Picnic areas, recreation areas, playgrounds, active sports areas, parks, residences, motels, hotels, schools, churches, libraries, and hospitals	67 (exterior)
C	Developed lands, properties, or activities not included in Categories A or B	72 (exterior)
D	Undeveloped lands	N/A
E	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, and auditoriums	52 (interior)

Source: FHWA, 1995

4.5.1.3 Aircraft Noise

Another metric used to quantify the noise environment is the A-weighted Day-night Sound Level (ADNL). Day-night Sound Level (DNL) is defined as the average sound energy in a 24–hour period with a 10–dB penalty added to the nighttime levels (10 p.m. to 7 a.m.). DNL is a useful descriptor for noise because (1) it averages ongoing yet intermittent noise, such as aircraft overflights, and (2) it measures total sound energy over a 24-hour period. The Federal Aviation Administration (FAA), DoD, and other organizations have adopted ADNL as the appropriate metric for estimating community annoyance from aircraft operations. In this analysis, ADNL is used to assess aircraft noise from Davison Army Airfield.

In June 1980, a Federal Interagency Committee on Urban Noise published guidelines (FICUN 1980) relating DNL to compatible (and incompatible) land uses. Since these guidelines were issued, federal agencies have generally adopted them for aircraft related noise analyses. Although these guidelines are not mandatory, they are the most accepted criteria used to assess the effects of noise in areas surrounding airports. In general, residential land uses are not compatible with an outdoor DNL above 65 dBA.

4.5.1.4 Existing Ambient Noise Levels

Main Post, EPG, and GSA Parcel. Existing ambient noise levels for Noise Sensitive Receptors (NSR) adjacent to the main traffic routes near the Main Post, EPG, and the GSA Parcel were modeled using the FHWA's Traffic Noise Model (TNM), Version 2.5. TNM combines noise levels of automobiles, medium and heavy trucks, busses, and motorcycles. TNM computes $L_{eq}(1)$ for comparison to the FHWA NAC. Several NSRs (including several residences, one school, and two churches) adjacent to the main traffic routes were category B land uses that were identified and carried forward for detailed analysis (Figure 4.5-1). Selected NSRs were the closest to the roadway of interest and were considered worst-case. All other NSRs would have both existing and future noise levels less than of the chosen NSR.

Morning and afternoon peak traffic periods have the highest potential for adverse noise conditions. Noise modeling was conducted using traffic information obtained during peak traffic hours at adjacent intersections. Estimated existing noise levels for the NSRs are summarized in Table 4.5-4. Existing noise levels do not exceed the NAC for category B land uses (67-dBA) at any of the sites identified.

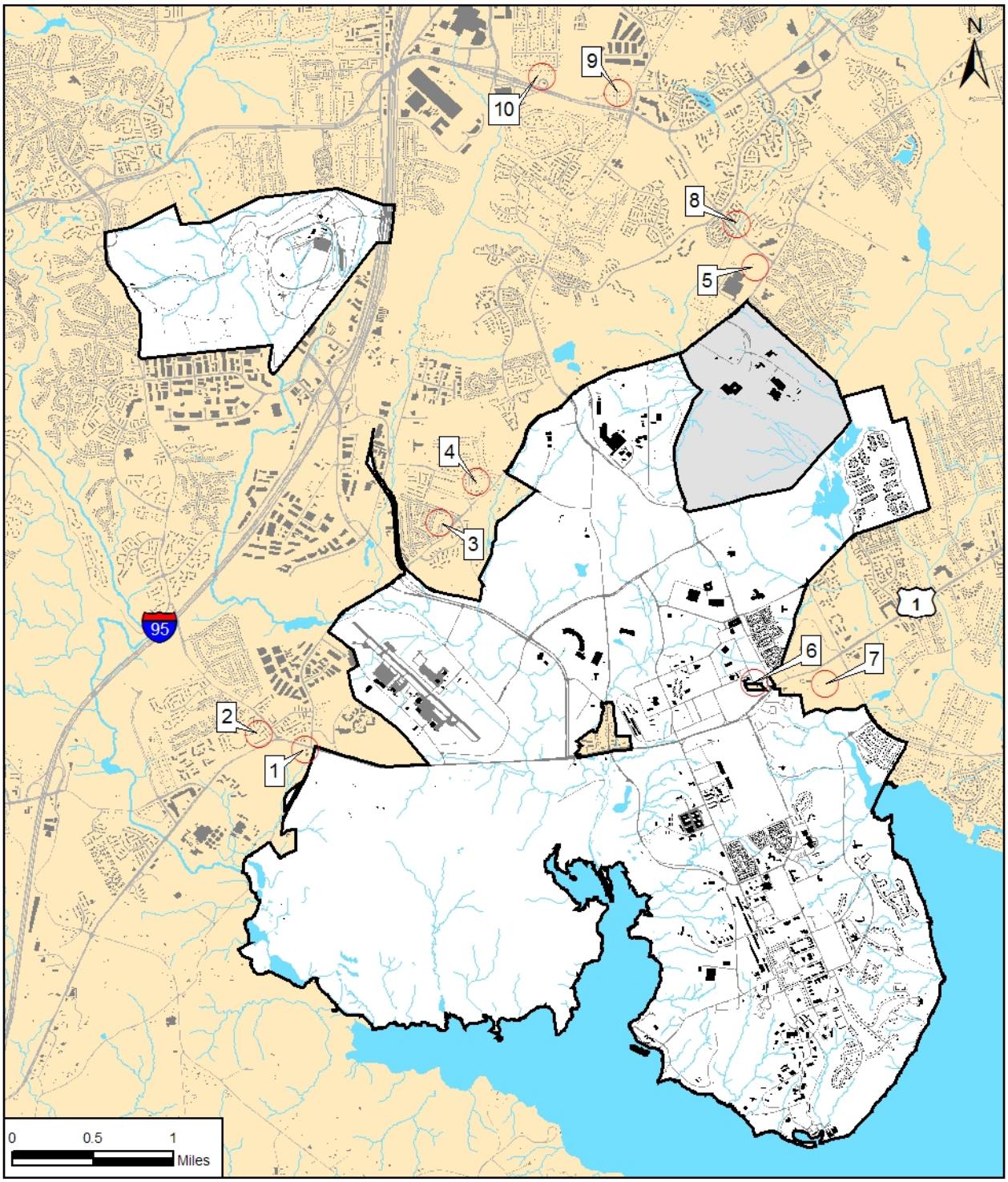
Davison Army Airfield is in the western portion of the Main Post and primarily serves five tenant units that operate aircraft such as C-12, C-172, UH-60, UH-1, and other military and general aviation aircraft. The airfield supports operations from helicopters, military fixed-wing aircraft, military jets, and general aviation aircraft (Wyle, 2000).

A review of the airfield's noise footprint and its compatibility with surrounding land uses on and adjacent to the Main Post was performed. This analysis was conducted using the NOISEMAP aircraft noise prediction model. NOISEMAP incorporates a database of known sound levels from various military aircraft and predicts noise levels (ADNL) from aircraft operations at and around military airfields. In 2004, approximately 26 acres of off-post land, including 11 residences, were exposed to ADNL levels greater than 65-dB. This area, adjacent to the Main Post, is not considered compatible with the existing noise environment.

There are no aircraft operations associated with EPG or the GSA Parcel. The 65-dB ADNL contour from Davison Airfield is confined to the Main Post and a limited area adjacent to it. Although the predominant flight track to and from the airfield is directly over EPG, the limited size and frequency of overflight events do not create any incompatible land uses within the boundaries of, or adjacent to, EPG or the GSA Parcel. EPG, GSA Parcel, and some areas on the Main Post outside the noise contours are exposed to mid-altitude aircraft overflight noise. These acoustical events are limited in level, duration, and frequency. They are not loud enough to create existing incompatible land uses of any of the areas being examined.

4.5.2 ENVIRONMENTAL CONSEQUENCES OF THE PREFERRED ALTERNATIVE

Implementing the Preferred Alternative would be expected to have both short-term and long-term minor adverse effects to the noise environment. However, minor increases in noise would not be



LEGEND

Installation Property

Approximate Noise Sensitive Receiver Location

Noise Sensitive Receptors

Fort Belvoir, Virginia

Sources: Fort Belvoir GIS, 2006; Fairfax County GIS, 2006.

Figure 4.5-1

Table 4.5-4
Estimated existing traffic noise levels for noise sensitive receptors

Noise sensitive receptor (NSR)	Description	Location	Distance to roadway centerline (feet)	Estimated $L_{eq}(1)$ (dBA)
1	Pohick Church	Route 1 east of Telegraph Road	100	64.6
2	Residence	Route 1 east of Telegraph Road	124	62.9
3	Residence	Telegraph Road between Fairfax County Parkway and Beulah Street	82	60.5
4	Residence	Telegraph Road between Fairfax County Parkway and Beulah Street	96	62.5
5	Hayfield Elementary School	Telegraph Road between Beulah Street and Hayfield	650	60.8
8	Residence	Hayfield east of Telegraph and west of Franconia Springfield Parkway	100	65.9
9	Residence	Franconia Springfield Parkway east of Backlick Road and west of Beulah Road	150	64.1
10	Residence	Franconia Springfield Parkway east of Backlick Road and west of Beulah Road	300	58.7

Source: FHWA, 2005.

Note: Currently No existing information is available for NSRs 6 and 7. Future baseline conditions for these NSRs are outlined under the No Action Alternative.

expected to contribute to a violation of any federal, state, or local regulations or introduce areas of incompatible land use due to noise.

4.5.2.1 Land Use Plan Update

The planning activities associated with the land use plan update under this alternative would not generate any direct or indirect noise. Therefore, updating the land use plan designations (comparison of 1993 land use [Figure 2-1] versus proposed [Figure 2-2]) would have no affect on the noise environment. Development on EPG doubles Professional/Institutional land use acreage, a likely adverse effect due to new noise sources where there previously were few activities occurring at EPG. Detailed analysis is presented in the next section on BRAC implementation and potential effects associated with noise-producing activities.

4.5.2.2 BRAC Implementation and Facilities Projects

Implementing the BRAC action under the Preferred Alternative would change the existing noise environment. These changes would be primarily due to construction activities, changes in traffic

patterns, and the establishment of new facilities on both the Main Post and EPG. The following is a discussion of these changes and potential effects.

4.5.2.2.1 Construction Noise

Main Post and EPG. The Preferred Alternative would require construction activities at the Main Post and EPG. Individual pieces of construction equipment typically generate noise levels of 80 to 90 dBA at a distance of 50 feet. With multiple items of equipment operating concurrently, noise levels can be relatively high during daytime periods at locations within several hundred feet of active construction sites. The zone of relatively high construction noise typically extends to distances of 400 to 800 feet from the site of major equipment operations. Locations more than 1,000 feet from construction sites seldom experience noteworthy levels of construction noise. Table 4.5-5 presents typical noise levels (dBA at 50 feet) that EPA has estimated for the main phases of outdoor construction. Given the temporary nature of proposed construction activities and the limited amount of noise that construction equipment would generate, this effect would be considered minor.

Table 4.5-5
Noise levels associated with outdoor construction

Construction phase	Sound level (dBA)
Ground clearing	84
Excavation, grading	89
Foundations	78
Structural	85
Finishing	89

Source: USEPA, 1971

Construction noise would be expected to dominate the soundscape for all on-site personnel. Construction personnel, and particularly equipment operators, would don adequate personal hearing protection to limit exposure and ensure compliance with federal health and safety regulations.

4.5.2.2.2 Traffic Noise

Noise levels for NSRs adjacent to the main traffic routes near the Main Post and EPG were modeled using traffic information obtained during peak traffic hours for the Preferred Alternative. By implementing the Preferred Alternative, estimated noise levels would not exceed the NAC for category B land uses (67 dBA) at any of the sites identified. In addition, the change in levels would not be perceptible (greater than 3 dB change) over the levels associated with the implementation of the No Action Alternative (Table 4.5-6). These effects would be negligible when compared to the future conditions without implementing the BRAC action. New access roads at EPG would introduce a minor increase in traffic noise for nearby NSR. However, the traffic volume would be much less than, and the distance to the closest NSR would be greater than, any of the locations considered in this analysis. Therefore, levels are not expected to exceed the NAC for category B land uses (67 dBA) at any of these locations.

Table 4.5-6
Estimated traffic noise levels for noise sensitive receptors for the Preferred Alternative

Noise sensitive receptor (NSR)	Description	Location	Distance to roadway centerline (feet)	Estimated $L_{eq}(1)$ (dBA)	No Action estimated $L_{eq}(1)$ (dBA)	Change in level $L_{eq}(1)$ (dBA)
1	Pohick Church	Route 1 east of Telegraph Road	100	65.4	64.7	0.7
2	Residence	Route 1 east of Telegraph Road	124	63.7	62.9	0.8
3	Residence	Telegraph Road between Fairfax County Parkway and Beulah Street	82	61.4	61.3	0.1
4	Residence	Telegraph Road between Fairfax County Parkway and Beulah Street	96	63.5	63.4	0.1
5	Hayfield Elementary School	Telegraph Road between Beulah Street and Hayfield	650	61.2	61.2	0.0
6	Alexandria Friends Meeting House	Route 1 between Belvoir Road and Mt. Vernon Road	375	55.8	55.7	0.1
7	Woodlawn Baptist Church	Route 1 between Belvoir Road and Mt. Vernon Road	200	60.5	60.0	0.5
8	Residence	Hayfield east of Telegraph and west of Franconia Springfield Parkway	100	66.4	66.4	0.0
9	Residence	Franconia Springfield Parkway east of Backlick west of Beulah	150	64.3	64.3	0.0
10	Residence	Franconia Springfield Parkway east of Backlick west of Beulah	300	59.0	59.0	0.0

Source: FHWA, 2005.

4.5.2.2.3 Aircraft Noise and Military Training Noise

The primary use of the proposed facilities would be administrative office space. There would be no changes to aircraft operations, small arms training, artillery training, or use of demolitions at Fort Belvoir with the implementation of the Preferred Alternative. Therefore, there would be no changes in the existing noise environment due to these types of activities. In addition, the selected sites for the new facilities would not be in areas of incompatible land use due to noise generated by air operations at Davison Army Airfield.

4.5.2.3 BMPs/Mitigation

BMPs. BMPs would be required and implemented for construction noise associated with this alternative. BMPs implemented during construction may include:

- Limting construction to predominately occur during normal weekday business hours in areas adjacent to noise-sensitive land uses such as residential areas, recreational areas, and off-post areas
- Properly maintaining construction equipment mufflers to be in good working order.

Mitigation. No specific mitigation measures with respect to noise would be required with the implementation of the Preferred Alternative.

4.5.3 ENVIRONMENTAL CONSEQUENCES OF THE TOWN CENTER ALTERNATIVE

Implementing the Town Center Alternative would be expected to have both short-term and long-term minor adverse effects to the noise environment. However, minor increases in noise would not be expected to contribute to a violation of any federal, state, or local regulations or introduce areas of incompatible land use due to noise.

4.5.3.1 Land Use Plan Update

The planning activities associated with the land use plan update under this alternative would not generate any direct or indirect noise. Therefore, updating the land use plan designations would have no affect on the noise environment. Detailed analysis is presented in the next section on BRAC implementation and potential effects associated noise-producing activities.

4.5.3.2 BRAC Implementation and Facilities Projects

Implementing the BRAC action under this alternative would change the existing noise environment. These changes would be primarily due to construction activities, changes in traffic patterns, and the establishment of new facilities on both the Main Post and EPG. The following is a discussion of these changes and potential effects.

4.5.3.2.1 Construction Noise

Main Post. Under the Town Center Alternative, construction activities would take place at the Main Post only. Construction noise would be similar to those outlined under the Preferred Alternative for the Main Post and EPG. Therefore, due to the limited noise (both levels and time of day) and the temporary nature associated with construction, these effects would be considered minor.

EPG. The Town Center Alternative would not require construction activities at EPG. Therefore, there would be no effect due to construction noise at these locations.

4.5.3.2.2 Traffic Noise

Noise levels for NSRs adjacent to the main traffic routes near the Main Post and EPG were modeled using traffic information obtained during peak traffic hours for the Town Center Alternative. By implementing the Town Center Alternative, estimated noise levels would not exceed the NAC for category B land uses (67 dBA) at any of the sites identified. In addition, the

change in levels would not be perceptible (greater than 3 dB change) over the levels associated with the implementation of the No Action Alternative (Table 4.5-7). These effects would be negligible when compared to the future conditions without implementing the BRAC action.

4.5.3.2.3 Aircraft Noise and Military Training Noise

The primary use of the proposed facilities would be administrative office space. There would be no changes to aircraft operations, small arms training, artillery training, or use of demolitions at Fort Belvoir with the implementation of the Town Center Alternative. Therefore, there would be no changes in the existing noise environment due to these types of activities. In addition, the selected sites for the new facilities would not be in areas of incompatible land use due to noise generated by air operations at Davison Army Airfield.

Table 4.5-7
Estimated traffic noise levels for noise sensitive receptors for the Town Center Alternative

Noise sensitive receptor (NSR)	Description	Location	Distance to roadway centerline (feet)	Estimated $L_{eq}(1)$ (dBA)	No Action estimated $L_{eq}(1)$ (dBA)	Change in level $L_{eq}(1)$ (dBA)
1	Pohick Church	Route 1 east of Telegraph Road	100	65.2	64.7	0.5
2	Residence	Route 1 east of Telegraph Road	124	63.5	62.9	0.6
3	Residence	Telegraph Road between Fairfax County Parkway and Beulah Street	82	61.4	61.3	0.1
4	Residence	Telegraph Road between Fairfax County Parkway and Beulah Street	96	63.5	63.4	0.1
5	Hayfield Elementary School	Telegraph Road between Beulah Street and Hayfield	650	61.2	61.2	0.0
6	Alexandria Friends Meeting House	Route 1 between Belvoir Road and Mt. Vernon Road	375	55.6	55.7	-0.1
7	Woodlawn Baptist Church	Route 1 between Belvoir Road and Mt. Vernon Road	200	60.3	60.0	0.3
8	Residence	Hayfield east of Telegraph and west of Franconia Springfield Parkway	100	66.3	66.4	-0.1
9	Residence	Franconia Springfield Parkway east of Backlick west of Beulah	150	64.3	64.3	0.0
10	Residence	Franconia Springfield Parkway east of Backlick west of Beulah	300	59.0	59.0	0.0

Source: FHWA, 2005.

4.5.3.3 BMPs/Mitigation

BMPs. BMPs would be similar to those listed in Section 4.5.2.3.

Mitigation. No specific mitigation measures with respect to noise would be required with the implementation of the Town Center Alternative.

4.5.4 ENVIRONMENTAL CONSEQUENCES OF THE CITY CENTER ALTERNATIVE

Implementing the City Center Alternative would be expected to have both short-term and long-term minor adverse effects to the noise environment. However, minor increases in noise would not be expected to contribute to a violation of any federal, state, or local regulations or introduce areas of incompatible land use due to noise.

4.5.4.1 Land Use Plan Update

The planning activities associated with the land use plan update under this alternative would not generate any direct or indirect noise. Therefore, updating the land use plan designations would have no affect on the noise environment. Detailed analysis is presented in the next section on BRAC implementation and potential effects associated noise-producing activities.

4.5.4.2 BRAC Implementation and Facilities Projects

Implementing the BRAC action under this alternative would change the existing noise environment. These changes would be primarily due to construction activities, changes in traffic patterns, and the establishment of new facilities on both the Main Post and EPG. The following is a discussion of these changes and potential effects.

4.5.4.2.1 Construction Noise

Under the City Center Alternative construction, activities would take place at the Main Post, EPG and the GSA Parcel. Construction noise at these locations would be similar to those outlined under the Preferred Alternative for the Main Post and EPG. Therefore, due to the limited noise (both levels and time of day) and the temporary nature associated with construction, these effects would be considered minor.

4.5.4.2.2 Traffic Noise

Noise levels for NSRs adjacent to the main traffic routes near the Main Post, EPG, and the GSA Parcel were modeled using traffic information obtained during peak traffic hours for the City Center Alternative. By implementing the City Center Alternative, estimated noise levels would not exceed the NAC for category B land uses (67 dBA) at any of the sites identified. In addition, the change in levels would not be perceptible (greater than 3 dB change) over the levels associated with the implementation of the No Action Alternative (Table 4.5-8). These effects would be negligible when compared to the future conditions without the implementation of the BRAC action.

4.5.4.2.3 Aircraft Noise and Military Training Noise

The primary use of the proposed facilities would be administrative office space. There would be no changes to aircraft operations, small arms training, artillery training, or use of demolitions at Fort Belvoir with the implementation of the City Center Alternative. Therefore, there would be no changes in the existing noise environment due to these types of activities. In addition, the

Table 4.5-8
Estimated traffic noise levels for noise sensitive receptors for the City Center Alternative

Noise sensitive receptor (NSR)	Description	Location	Distance to roadway centerline (feet)	Estimated $L_{eq}(1)$ (dBA)	No Action estimated $L_{eq}(1)$ (dBA)	Change in level $L_{eq}(1)$ (dBA)
1	Pohick Church	Route 1 east of Telegraph Road	100	65.8	64.7	1.1
2	Residence	Route 1 east of Telegraph Road	124	64.0	62.9	1.1
3	Residence	Telegraph Road between Fairfax County Parkway and Beulah Street	82	62.0	61.3	0.7
5	Hayfield Elementary School	Telegraph Road between Beulah Street and Hayfield	650	61.3	61.2	0.1
6	Alexandria Friends Meeting House	Route 1 between Belvoir Road and Mt. Vernon Road	375	56.3	55.7	0.6
7	Woodlawn Baptist Church	Route 1 between Belvoir Road and Mt. Vernon Road	200	61.0	60.0	1.0
8	Residence	Hayfield east of Telegraph and west of Franconia Springfield Parkway	100	66.4	66.4	0.0
9	Residence	Franconia Springfield Parkway east of Backlick west of Beulah	150	64.4	64.3	0.1
10	Residence	Franconia Springfield Parkway east of Backlick west of Beulah	300	59.1	59.0	0.1

Source: FHWA, 2005.

selected sites for the new facilities would not be in areas of incompatible land use due to noise generated by air operations at Davison Army Airfield. New access roads at EPG and the GSA parcel would introduce a minor increase in traffic noise for nearby NSR. However, the traffic volume would be much less than, and the distance to the closest NSR would be greater than, any of the locations considered in this analysis. Therefore, levels are not expected to exceed the NAC for category B land uses (67 dBA) at any of these locations.

4.5.4.3 BMPs/Mitigation

BMPs. BMPs would be similar to those listed in Section 4.5.2.3.

Mitigation. No specific mitigation measures with respect to noise would be required with the implementation of the City Center Alternative.

4.5.5 ENVIRONMENTAL CONSEQUENCES OF THE SATELLITE CAMPUSES ALTERNATIVE

Implementing the Satellite Campuses Alternative would be expected to have both short-term and long-term minor adverse effects to the noise environment. However, minor increases in noise would not be expected to contribute to a violation of any federal, state, or local regulations or introduce areas of incompatible land use due to noise.

4.5.5.1 Land Use Plan Update

The planning activities associated with the land use plan update under this alternative would not generate any direct or indirect noise. Therefore, updating the land use plan designations would have no affect on the noise environment. Detailed analysis is presented in the next section on BRAC implementation and potential effects associated noise-producing activities.

4.5.5.2 BRAC Implementation and Facilities Projects

Implementing the BRAC action under this alternative would change the existing noise environment. These changes would be primarily due to construction activities, changes in traffic patterns, and the establishment of new facilities on both the Main Post and EPG. The following is a discussion of these changes and potential effects.

4.5.5.2.1 Construction Noise

Main Post. Under the Satellite Campuses Alternative, construction activities would take place at the Main Post only. Construction noise would be similar to those outlined under the Preferred Alternative for the Main Post and EPG. Therefore, due to the limited noise (both levels and time of day) and the temporary nature associated with construction, these effects would be considered minor.

EPG. The Satellite Campuses Alternative would not require construction activities at EPG. Therefore, there would be no effect due to construction noise at these locations.

4.5.5.2.2 Traffic Noise

Noise levels for NSRs adjacent to the main traffic routes near the Main Post and EPG were modeled using traffic information obtained during peak traffic hours for the Satellite Campuses Alternative. By implementing the Satellite Campuses Alternative, estimated noise levels would not exceed the NAC for category B land uses (67 dBA) at any of the sites identified. In addition, the change in levels would not be perceptible (greater than 3 dB change) over the levels associated with the implementation of the No Action Alternative (Table 4.5-9). These effects would be negligible when compared to the future conditions without the implementation of the BRAC action.

4.5.5.2.3 Aircraft Noise and Military Training Noise

Under the Satellite Campus Alternative, DAAF would be closed to allow for the establishment of the NGA facilities. Aircraft operations would potentially cease and a corresponding net benefit to the noise environment realized. There would be no changes to aircraft operations, small arms training, artillery training, or use of demolitions at Fort Belvoir with the implementation of the Satellite Campuses Alternative. Therefore, there would be no changes in the existing noise environment due to these types of activities. In addition, the selected sites for the new facilities

Table 4.5-9
Estimated traffic noise levels for noise sensitive receptors for the Satellite Campuses Alternative

Noise sensitive receptor (NSR)	Description	Location	Distance to roadway centerline (feet)	Estimated $L_{eq}(1)$ (dBA)	No Action estimated $L_{eq}(1)$ (dBA)	Change in level $L_{eq}(1)$ (dBA)
1	Pohick Church	Route 1 east of Telegraph Road	100	65.5	64.7	0.8
2	Residence	Route 1 east of Telegraph Road	124	63.7	62.9	0.8
3	Residence	Telegraph Road between Fairfax County Parkway and Beulah Street	82	61.8	61.3	0.5
4	Residence	Telegraph Road between Fairfax County Parkway and Beulah Street	96	63.9	63.4	0.5
5	Hayfield Elementary School	Telegraph Road between Beulah Street and Hayfield	650	61.3	61.2	0.1
6	Alexandria Friends Meeting House	Route 1 between Belvoir Road and Mt. Vernon Road	375	56.0	55.7	0.3
7	Woodlawn Baptist Church	Route 1 between Belvoir Road and Mt. Vernon Road	200	60.7	60.0	0.7
8	Residence	Hayfield east of Telegraph and west of Franconia Springfield Parkway	100	66.4	66.4	0.0
9	Residence	Franconia Springfield Parkway east of Backlick west of Beulah	150	64.3	64.3	0.0
10	Residence	Franconia Springfield Parkway east of Backlick west of Beulah	300	59.0	59.0	0.0

Source: FHWA, 2005.

would not be in areas of incompatible land use due to noise generated by air operations at Davison Army Airfield.

4.5.5.3 BMPs/Mitigation

BMPs. BMPs would be similar to those listed in Section 4.5.2.3.

Mitigation. No specific mitigation measures with respect to noise would be required with the implementation of the Satellite Campuses Alternative.

4.5.6 NO ACTION ALTERNATIVE

Implementing the No Action Alternative would be expected to have no effects to the noise environment.

4.5.6.1 Land Use Plan Update

Under the No Action Alternative, BRAC-related construction or changes in operations would not take place. Therefore, there would be no effect on the noise environment.

4.5.6.2 BRAC Implementation and Facilities Projects

Although there would be no implementation of the BRAC action under this Alternative, traffic would increase due to in-place regional growth. An analysis of the future traffic noise environment was carried forward as a comparative baseline for the other alternatives under consideration.

Noise levels for NSRs adjacent to the main traffic routes near the Main Post, EPG, and the GSA Parcel were modeled using traffic information obtained during peak traffic hours for the No Action Alternative. By implementing the No Action Alternative, estimated noise levels would not exceed the NAC for category B land uses (67 dBA) at any of the sites identified (Table 4.5-10).

Table 4.5-10
Estimated traffic noise levels for noise sensitive receptors for the No Action Alternative

Noise sensitive receptor (NSR)	Description	Location	Distance to roadway centerline (feet)	No Action estimated L_{eq}(1) (dBA)
1	Pohick Church	Route 1 east of Telegraph Road	100	64.7
2	Residence	Route 1 east of Telegraph Road	124	62.9
3	Residence	Telegraph Road between Fairfax County Parkway and Beulah Street	82	61.3
4	Residence	Telegraph Road between Fairfax County Parkway and Beulah Street	96	63.4
5	Hayfield Elementary School	Telegraph Road between Beulah Street and Hayfield	650	61.2
6	Alexandria Friends Meeting House	Route 1 between Belvoir Road and Mt. Vernon Road	375	55.7
7	Woodlawn Baptist Church	Route 1 between Belvoir Road and Mt. Vernon Road	200	60.0
8	Residence	Hayfield east of Telegraph and west of Franconia Springfield Parkway	100	66.4
9	Residence	Franconia Springfield Parkway east of Backlick west of Beulah	150	64.3
10	Residence	Franconia Springfield Parkway east of Backlick west of Beulah	300	59.0

Source: FHWA, 2005.

There would be no changes to aircraft operations, small arms training, artillery training, or use of demolitions at Fort Belvoir with the implementation of the Satellite Campuses Alternative. Therefore, there would be no changes in the existing noise environment due to these types of activities. In addition, the selected sites for the new facilities would not be in areas of incompatible land use due to noise generated by air operations at Davison Army Airfield.

4.5.6.3 BMPs/Mitigation

No BMPs or mitigation with respect to noise would be required with the implementation of the No Action Alternative.

4.5.7 SUMMARY OF COMPARISON OF ALTERNATIVES

For all the development alternatives, the BRAC action would be expected to have both short-term and long-term minor adverse effects to the noise environment. However, minor increases in noise would not be expected to contribute to a violation of any federal, state, or local regulations or introduce areas of incompatible land use due to noise.

Each development alternative would require construction activities at the Main Post, EPG, or the GSA Parcel. Individual pieces of construction equipment typically generate noise levels of 80 to 90 dBA at a distance of 50 feet. With multiple items of equipment operating concurrently, noise levels can be relatively high during daytime periods at locations within several hundred feet of active construction sites. The zone of relatively high construction noise typically extends to distances of 400 to 800 feet from the site of major equipment operations. Locations more than 1,000 feet from construction sites seldom experience noteworthy levels of construction noise. Given the temporary nature of proposed construction activities and the limited amount of noise that construction equipment would generate, this effect would be considered minor.

Noise levels for NSRs adjacent to the main traffic routes near the Main Post, EPG, and the GSA Parcel were modeled using traffic information obtained during peak traffic hours for all the alternatives. Estimated noise levels would not exceed the noise-abatement criteria for residential land uses (67 dBA). In addition, the change in levels would not be perceptible (greater than 3 dB change) over the levels associated with the implementation of the No Action Alternative. These effects would be negligible when compared to the future conditions without the implementation of the BRAC action.

There would be no changes to aircraft operations, small arms training, artillery training, or use of demolitions at Fort Belvoir by implementing the BRAC action. Therefore, there would be no changes in the existing noise environment due to these types of activities. In addition, the selected sites for the new facilities would not be in areas of incompatible land use due to noise generated by air operations at Davison Army Airfield.

4.6 TOPOGRAPHY, GEOLOGY, AND SOILS

4.6.1 AFFECTED ENVIRONMENT

4.6.1.1 Topography

Main Post. The topography of Fort Belvoir's Main Post (Figure 4.6-1, Topography of Fort Belvoir) is characterized by uplands and plateaus, lowlands, and steeply sloped terrain. The land ranges in elevation from approximately sea level along the Potomac River to approximately 230 feet above mean sea level (msl) near the intersection of Beulah Street and Woodlawn Road in the upland area of the installation (Horne, 2001).

Uplands and plateaus make up approximately 40 percent of the installation. Upland areas dominate the topography on the North Post and are gently rolling to steeply sloped. The South Post and Southwest Area contain nearly level plateaus that are oriented from north to south. The South Post plateau is almost a mile wide and extends from Route 1 southeast to 23rd Street. Another plateau is in the Southwest Area. This plateau is lower in elevation and more gently sloping than the South Post plateau (Horne, 2001).

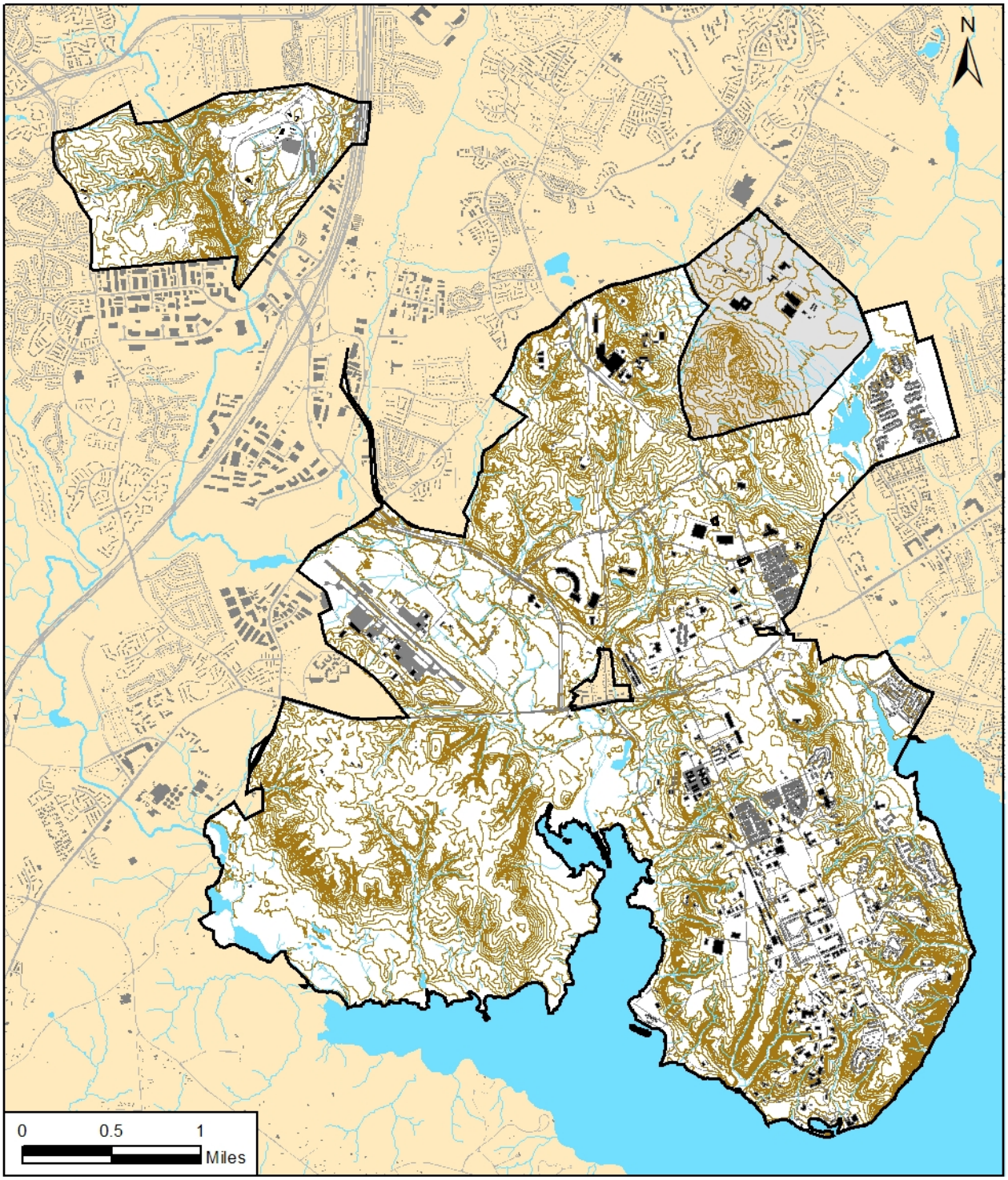
Lowlands make up another 40 percent or so of the land at Fort Belvoir. Lowland areas on Fort Belvoir are mostly associated with the floodplains of Accotink, Pohick, and Dogue Creeks. Additional lowland areas exist between the shoreline and the steeply sloped terrain that surrounds the two plateaus. The lowland topography is gently sloped (from about 10 percent at their upland fringes to almost zero along the active floodplains) (Horne, 2001).

Steeply sloped (greater than 20 percent) terrain characterizes the remaining 20 percent of the installation's land. Areas of steeply sloped terrain, ravines, and stream valleys surround the two plateaus separating them from the lowlands. Seeps and springs occur along slope faces. Fringe slopes surrounding the South Post plateau range from 20 to 90 percent. Southeast of 23rd Street, the ground plunges to approximately sea level at slopes that range from 10 to almost 90 percent along the southern edge of Fairfax Village. Unstable, steep-slope conditions are mostly because of a combination of weakly cemented sedimentary substrates and wind and water erosion near the Potomac River (Horne, 2001).

Steep and highly erodible slopes are also found along the eastern and western edges of the Southwest Area plateau and in deeply cut stream channels. These slopes range from 10 to 50 percent (Horne, 2001).

EPG. The topography of EPG is gently rolling, except for steep slopes bordering Accotink Creek. Accotink Creek enters EPG from the north at an elevation of approximately 120 feet above msl and descends to an elevation of approximately 100 feet msl before exiting EPG to the south. Steep slopes rise from both the eastern and western banks of Accotink Creek to an elevation of approximately 200 feet above msl, forming a narrow stream valley. The grades on the slopes range between 20 and 30 percent at most locations (USGS, 1984).

The areas to the east of Accotink Creek range in elevation between approximately 200 and 230 feet above msl. The highest lands are situated in the northern part of Heller Loop, and elevations descend gently to the south and west. Elevations also descend sharply toward the eastern and northern perimeters of EPG, along the creek beds for small unnamed tributaries to Accotink Creek. The areas to the west of Accotink Creek range in elevation between approximately 200



LEGEND

Installation Property

10' Contour Interval

Topography of Fort Belvoir

Fort Belvoir, Virginia

Sources: Fort Belvoir GIS, 2006; Fairfax County GIS, 2006.

Figure 4.6-1

and 300 feet msl. The highest lands are situated near the northwest corner of EPG, and elevations descend gently to the south and east (USGS, 1984).

GSA Parcel. The topography of the GSA Parcel is generally flat because almost the entire site has been graded to support the construction of warehouse buildings. Portions of the parcel that have not been cut or filled slope slightly upward from the east side where the lowest point is approximately 200 feet above msl to the west side where the highest point reaches just over 240 feet above msl (Fairfax County, 2002).

4.6.1.2 Geology and Soils

The following sections provide detailed descriptions of geology and soils on Fort Belvoir.

4.6.1.2.1 Geology

Main Post. Fairfax County is divided into two physiographic provinces: the Coastal Plain and the Piedmont Plateau (Hobson, 1996). The fall line, which runs north to south through Virginia, crosses Fairfax County and forms the boundary between the resistant, metamorphic rocks of the Piedmont and the softer, sedimentary rocks of the Coastal Plain (Terwilliger, 1991,).

Fort Belvoir's Main Post lies below the fall line within the high and low Coastal Plain Terraces of the Coastal Plain Physiographic Province, which are two of the five Fairfax County province sub-sections. There are several geologic formations associated with the Coastal Plain Physiographic Province, including the Potomac Formation, Bacons Castle Formation, Shirley Formation, and Alluvium and Pliocene sand and gravel (Hobson, 1996,). The Potomac Formation outcrops along the slopes leading down to the Potomac River shoreline on the Main Post.

The Coastal Plain Physiographic Province consists of unconsolidated sand, silt, and clay underlain by residual soil and weathered crystalline rocks. Most of the Coastal Plain Physiographic Province deposits in the Fort Belvoir area consist of a sequence of unconsolidated sediments that belong to the Potomac Group (Hobson, 1996,).

The Potomac Group is characterized by lens-shaped deposits of interbedded sand, silt, clay, and gravel, primarily of non-marine origin. The Potomac Group is approximately 600 feet thick beneath most of Fort Belvoir (Law Engineering and Environmental Services, 1995, as cited in U.S. Army 2001).

Fort Belvoir's uplands are underlain by sands, silts, and clays of riverine origin. Uplands underlain by sands and silts tend to be more stable than those underlain by clays. Uplands that are underlain by clayey soils form undulating and rolling hills where the dominant land-forming process is mass wasting, which includes downhill creep, landslides, slumping, and rockfalls. Lowlands and valley bottoms are typically underlain with sediments deposited by moving water (Horne, 2001). The dominant land-forming process in these lower areas is active riverine erosion and deposition during overbank flooding. Surface drainage is commonly poor due to the shallow water table. Drainage usually occurs as surface runoff, with runoff greatest on the steeper slopes. The extent of runoff increases with construction activity and the removal of vegetation, which in turn increases the rate of erosion and the probability of creep and slumping.

EPG. EPG is near the Fall Line, which is the northeastern-trending physiographic boundary separating the eastern edge of the Piedmont Upland physiographic province and the western edge of the Coastal Plain physiographic province (USATHAMA, 1990). Piedmont areas consist

largely of Precambrian metamorphic and Cambrian igneous rock formations, whereas Coastal Plain areas consists of an eastward thickening wedge of unconsolidated sediments of gravel, sand, silt, and clay from the Cretaceous to Tertiary periods.

Rock formations from both provinces can be found within the boundaries of EPG as a finger of Piedmont Upland province bedrock extends from north to south along Accotink Creek. Piedmont Upland bedrock outcrops form the bed and adjacent slopes of the creek. Most of the more gently sloping areas to the east and west of the creek consist of unconsolidated deposits from the Coastal Plain province.

GSA Parcel. The GSA Parcel is in the Coastal Plain physiographic province, northeast of EPG and directly north of the Main Post. Similar to the eastern portion of EPG, the site is underlain by unconsolidated sediments (gravel, sand, silt and clay) (USATHAMA, 1990). Land-forming activity within the parcel is limited because of its small size, gentle slope, and the fact that much of the area is covered with impervious surfaces.

4.6.1.2.2 Soils

Main Post. The Natural Resource Conservation Service (NRCS, formerly the Soil Conservation Service) surveyed Fort Belvoir Main Post soils in 1982. The NRCS soil survey described and delineated 19 named soil series within Fort Belvoir. The survey data have been incorporated into the Fort Belvoir Geographic Information System. In addition to the 19 named soil series, there are areas of mixed waterborne sediments (Entisols) and tidal marsh (Histosols) that are not sufficiently defined to be classified as series (Horne, 2001).

Of the area included in the survey, 1,898 acres are described as urban built-up, and 587 acres are cut and fill. The urban, built-up unit includes primarily ridgetop or other well-drained, flatter areas that have been disturbed minimally to drastically by construction and development over the years. Areas within the urban, built-up units that are not under buildings or pavement are vegetated, and soil fertility is maintained by fertilizer application and landscaping. The cut-and-fill unit consists of areas where soil material has been removed (cut) and non-native material placed into low areas (fill) in order to level/lower slopes, facilitating construction activities. Fill material is generally of unknown source but is likely to be material selected for high structural stability following placement. Table 4.6-1 lists the soils mapped within Fort Belvoir Main Post, along with some selected features (Horne, 2001). Figure 4.6-2 (Soils of Fort Belvoir) depicts the distribution of soil types throughout the Main Post and EPG.

For each soil type, Table 4.6-1 provides soil name; drainage and problem classes; whether they are highly erodible or subject to flooding; foundation support rating; and acreage. The problem class ranks the installation's soils with respect to the degree of difficulty they present in building-site development, including the construction of buildings with and without basements; local roads and streets; shallow excavations; small commercial buildings; and lawns and landscaping. Soils classified as problem class A are severe and present significant, unfavorable constraints to development and require substantial design work, increased construction costs, and increased maintenance work, with lesser problems associated with classes B and C in that order. Each class is further defined below.

- ***Problem Class A***. Problems attributed to these soils include unstable slopes and land slippage, high shrink-swell clays, poor foundation support, and high water table conditions. The Fairfax County Public Facilities Manual and Building Codes require that a geotechnical engineering report be prepared by or under the direction of a professional

Table 4.6-1
Fort Belvoir Main Post soils

Soil name (series-phase)	Drainage class	Problem Class	Highly erodible	Flooding	Foundation support	Acres
Dumfries sandy loam 2–50% slopes	WD	A	No	No	Generally stable west of I-95; could be unstable east of I-95 especially near marine clays	1,557
Beltsville silt loam 0–15% slope	MWD	B	Yes	No	Good with proper drainage; foundation drains and waterproofing necessary	805
Mattapex silt loam 2–15% slope	WD–MWD	B	Yes	No	Marginal; foundation drains and waterproofing needed	508
Mixed alluvial 0–2% slope	PD	A	No	Frequent (Jan–Dec)	Poor	479
Matapeake silt loam 2–15% slope	WD	C	Yes	No	Generally favorable	264
Lenoir silt loam 0–2% slope	SPD	B	Yes	No	Marginal	238
Lunt fine sandy loam 2–25% slope	WD–MWD	A	No	No	Stable above sands; could be unstable near marine clays	217
Keyport silt loam 0–2% slope	MWD	B	No	No	Fair	203
Wehadkee silt loam 0–2% slope	PD	A	Yes	Frequent (Nov–Jun)	Poor; basements not recommended	169
Bertie silt loam 0–2% slope	MWD	B	No	No	Marginal to poor; foundation drains needed for basements and crawl spaces	140
Sassafras fine sandy loam 2–15% slope	WD	C		No	No data	130
Woodstown fine sandy loam 0–15% slope	MWD	C	Yes	No	Marginal; foundation drains needed for basements and crawl spaces	119
Dragston fine sandy loam 0–2% slope	SPD	B	No	No	Marginal; foundation drains and waterproofing needed	103
Fallsington fine sandy loam 0–2% slope	PD	A	No	No	Poor	62
Quantico 7–25% slope	WD	No data	No	No	No data	60
Galestown loamy fine sand 0–2% slope	SED	C	Yes	No	Adequate for small buildings (three stories or fewer)	54
Chewacla silt loam 0–2% slope	SPD	A	Yes	Frequent (Nov–Apr)	Poor; basements not recommended	17

Table 4.6-1
Fort Belvoir Main Post soils *(continued)*

Soil name (series-phase)	Drainage class	Problem class	Highly erodible	Flooding	Foundation support	Acres
Urban 0-10% slope	N/A	Not rated	No	N/A	Suitable	1,742
Cut and fill	N/A	Not rated	N/A	N/A	Suitable	412
Unknown	N/A	Not rated	N/A	N/A	N/A	388
TOTAL						**7,793**

Sources: US SCS, 1982, as cited in Horne, 2001; Fairfax County, 2001a.
Drainage Class Abbreviations:
MWD = moderately well-drained SPD = somewhat poorly drained PD = poorly drained
VPD = very poorly drained SED = somewhat excessively drained WD = well-drained
See text for problem class definitions.

engineer experienced in soil and foundation engineering. The engineering evaluation and report must be submitted for approval, and the recommendations incorporated into the grading plans as requirements for construction prior to plan approval.

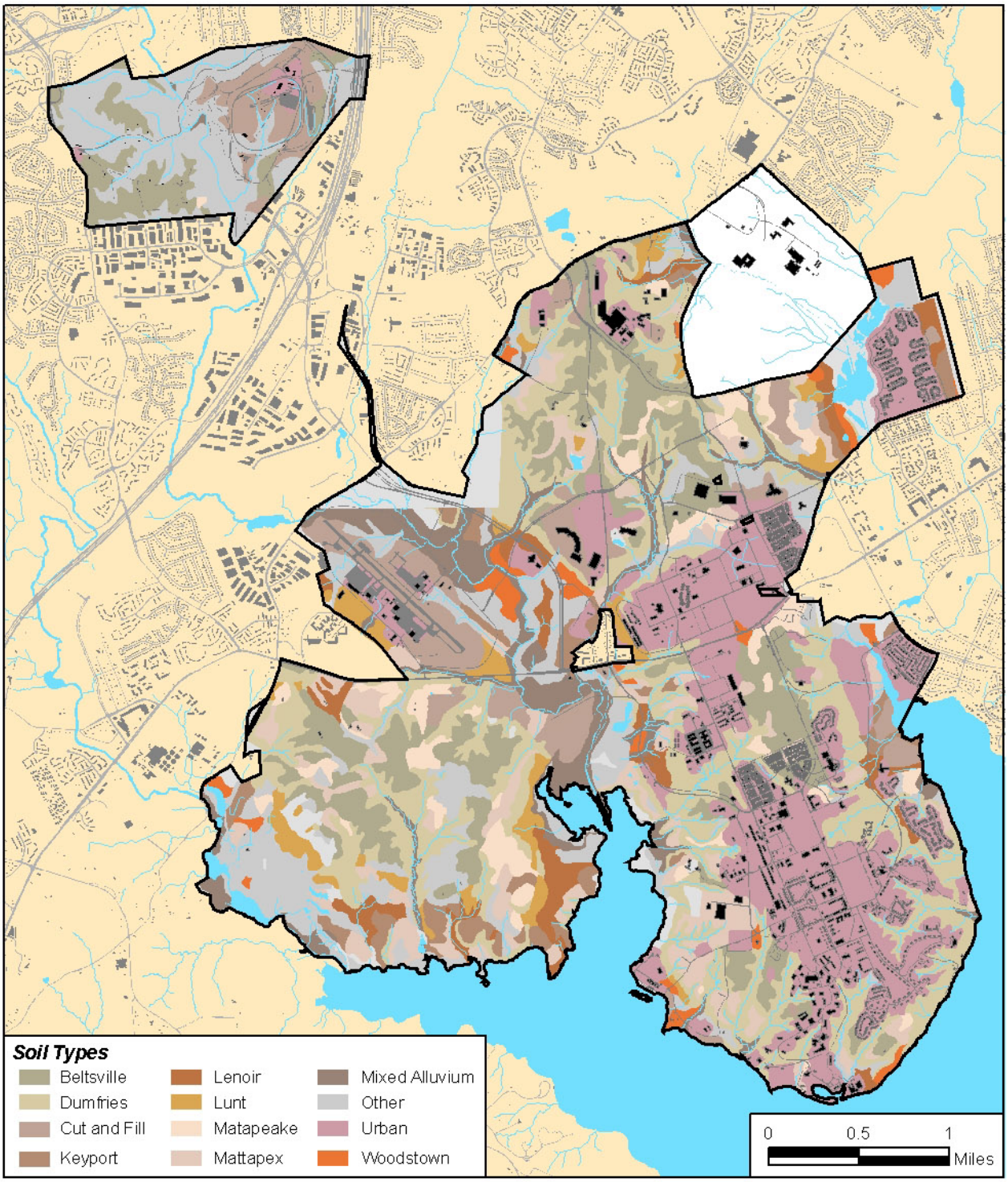
- ***Problem Class B***. Problems attributed to these soils primarily result from wetness and drainage problems that can be addressed on the construction plans with appropriate geotechnical notes and drawings, such as foundation drain details for basements and crawl spaces. Geotechnical investigation by an engineer is recommended; however, the submission of the resulting report for separate county approval may not be required in all cases.

- ***Problem Class C***. These soils are not considered problem soils for foundations. These soils typically have few problems that would adversely affect most residential uses. A geotechnical investigation by an engineer is recommended.

Regardless of the soil problem class, Fairfax County requires that a geotechnical report be prepared and submitted for major construction projects involving multi-story buildings, mat foundation, deep foundation, deep excavations, sheeting and shoring, retaining walls, embankments, and ground modification (Fairfax County, 2007).

Soils identified as having limitations with respect to building-site development are along streams and creeks along the shores of Pohick Bay, Accotink Bay, Gunston Cove, and the Potomac River. Limitations to construction include cutbank cave-ins, wetness, flooding, frost action related to the seasonally high water table, shrink-swell related to clay content, and slope and soil erosion. These coincide with steep slopes and wetland areas.

Five hydric soils types occur within the Main Post: Mixed Aluvial, Chewacla silt loam, Wehadkee silt loam, Fallsington fine sandy loam, and tidal marsh. These soils are typically associated with wetland areas including tidal flats and the areas within and immediately adjacent to floodplains. These soil types encompass approximately 931 acres. The location of these soils within the landscape generally results in limitations to development because of their tendency for flooding or saturation.



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Installation Property

Soils of Fort Belvoir

Fort Belvoir, Virginia

Sources: Fort Belvoir GIS, 2006; Fairfax County GIS, 2006.

Figure 4.6-2

Prime farmland is land federally designated under the Farmland Protection Policy Act (FFPA; 7 U.S.C. 4201) as having the best combination of physical and chemical characteristics for producing food, feed, fiber, forage, oilseed, and other agricultural crops with minimum inputs of fuel, fertilizer, pesticides, and labor and without intolerable soil erosion. Other land recognized under the FPPA includes unique farmland and farmland of statewide or local importance. Unique farmland is land other than prime farmland that is federally designated as important for production of specific high-value food and fiber crops. Farmland of statewide or local importance is land other than prime or unique farmland that is designated by state or local authorities as important for the production of food feed, fiber, forage, or oilseed crops. Status under any of the farmland designations is based on soil characteristics and does not depend on a history of current or past agricultural use. However, lands already in urban use or otherwise irreversibly committed to nonagricultural uses do not typically qualify.

Soil types on the Main Post designated as prime farmland account for approximately 1,283 acres, comprising the entire Mattaplex silt loam, Woodstown fine sandy loam, Matapeake silt loam, Sassafras fine sandy loam, and Glenelg silt loam units and approximately 12 acres of the Appling gritty loam type (Soil ID 60C) (Table 4.6-1) (EA, 2005). No lands on the Main Post contain soils designated as unique farmland.

EPG. Soils mapped on EPG by Fairfax County in 1990 are presented in Figure 4.6-2 and described in Table 4.6-2 (Fairfax County, 1990). The Fairfax County survey described and delineated 15 named soil series within EPG. The survey data have been incorporated into the Fort Belvoir Geographic Information System. Of the EPG area included in the survey, 121 acres are described as urban built-up, and approximately 7 acres are cut and fill (Paciulli, 1999). The developed areas include open areas surrounding former training and administrative building in the northeastern part of the Heller Loop, which is in the northeast quadrant of EPG; buildings near the intersection of Cissna and Telegaph Roads along the western edge of EPG; and smaller, scattered areas. Table 4.6-2 lists the soil types mapped within EPG, along with some selected features: soil name; drainage and problem classes; whether they are highly erodible or subject to flooding; foundation support rating; and acreage.

The only hydric soils mapped on EPG are Mixed Alluvial soils, which comprise approximately 26 acres of relatively level floodplain land adjoining Accotink Creek and the lower reach of an unnamed west-flowing tributary (Fairfax County, 2006a).

Within EPG, soils designated as prime farmland are limited to approximately 10 acres, comprising small areas mapped in the Meadowville and Birdsboro soil series (Table 4.6-2). No lands on EPG contain soils designated as unique farmland.

GSA Parcel. More than 68 acres of the 70-acre GSA Parcel consists of urban built-up soils. Mapped soil units make up a negligible portion of the area, with four different map units each contributing less than 1 acre (Fairfax County, 1990). The GSA Parcel contains no hydric or prime farmland soils (Fairfax County, 2006a).

Table 4.6-2
EPG soils

Soil name	Drainage class	Problem class	Highly erodible	Flooding	Foundation support	Acres
Beltsville silt loam 0–7% slope	MWD	B	Yes	No	Good, foundation drains and waterproofing needed	140
Louisburg coarse sandy loam, 7–25% slope	SED–WD	C	Yes	No	Good to marginal	108
Dumfries sandy loam, 7–50% slope[a]	WD	A	No	No	Marginal	83
Hyattsville, 2–7% slope	SPD	B	No	Yes within drainageway	Marginal to poor, foundation drains and waterproofing as necessary	67
Appling gritty loam, 2–14% slope	WD	C	No	No	Good	60
Mixed Alluvial, 0–2% slope	PD	A	No	Frequent (Jan–Dec)	Poor	26
Rocky Land (Acidic) 25–50% slope	WD	C	No	No	Good	9
Birdsboro 7–14% slope	WD	B	Yes	Yes	Marginal	6
Meadowville 2–7% slope	WD	B	Yes	Yes within drainageway	Marginal to poor, foundation drains and waterproofing needed	3
Fairfax (silt loam) 7–14% slope	WD	B	No	No	Favorable for small buildings, foundation drains and waterproofing needed	<1
Augusta (Loam) 2–7% slope	WD	B	No	Yes	Marginal	<1
Urban 0-10% slope	N/A	Not rated	N/A	N/A	Favorable	121
Cut and fill	N/A	Not rated	N/A	N/A	Suitable	7
Unclassified (Accotink Creek drainage)	N/A	N/A	N/A	N/A	N/A	175
TOTAL						**807**

[a] Dumfries sandy loam designation from the 1982 US SCS survey is designated as 61B-E, Loam and Gravelly Sediments, in the 1990 Fairfax County soil survey.

Sources: US SCS, 1982, as cited in Horne, 2001; Fairfax County, 1990; Fairfax County, 2001a.

Drainage Class Abbreviations:

MWD = moderately well-drained SPD = somewhat poorly drained PD = poorly drained
VPD = very poorly drained SED = somewhat excessively drained WD = well-drained
See text for problem class definitions.

4.6.2 ENVIRONMENTAL CONSEQUENCES OF THE PREFERRED ALTERNATIVE

The Preferred Alternative would be expected to have no effect on geology and result in localized changes in topography as a result of construction. Soils would undergo long-term direct effects where replaced with impervious surfaces and would experience short-term effects in areas disturbed in the process of developing structures and or installing infrastructure. A detailed description of the effects is presented below.

4.6.2.1 Topography

4.6.2.1.1 Land Use Plan Update

Development that could be allowed under the Preferred Alternative land use plan would result in localized long-term changes to topography resulting from construction. The change in land use designations with implementing the Preferred Alternative land use plan could produce more changes in topography than the 1993 land use plan because of the development, particularly roadways, that would be allowed on EPG. The Professional/ Institutional, Community, and Residential land uses would allow development in areas that were that were considered Environmentally Sensitive in the 1993 land use plan, although environmental constraints (e.g. endangered species habitat) would retain their protected status and continue to limit potential development in some of these areas. Changes to topography on the Main Post as a result of the change in land use plans would be minor and localized.

4.6.2.1.2 BRAC Implementation and Facilities Projects

Implementing the Preferred Alternative and other facilities projects would produce minor long-term changes to topography. Direct effects would result as the land in the vicinity of buildings and parking structures would generally be leveled although cuts in adjacent portions of the landscape could increase slopes. On EPG, construction would be concentrated in the relatively level areas on the plateaus east (NGA and WHS campuses) and west (remote inspection facility) of Accotink Creek, minimizing the overall effect. However, the placement of fill in association with stream crossings could result in an increase in the topography in the vicinity of the Accotink Creek drainage and its tributaries. On an installation-wide basis, these topographic changes would be minimal. Implementing the BRAC action would require upgrading existing roads and constructing new roads within EPG. Roads construction would also result in the leveling of the topography immediately below the pavement but would result in localized increases in slopes adjacent to the pavement as a result of cut and fill activities. The construction of roads on EPG would create changes in topography over a wider area than construction of buildings and parking structures. Therefore, this alternative would result in more changes to topography compared to alternatives that do not include substantial development on EPG (Town Center and Satellite Campuses Alternatives). While the degree of changes to topography would be greater under the Preferred Alternative than under the Town Center or Satellite Campuses Alternatives, the overall change would still be minor.

4.6.2.2 Geology

4.6.2.2.1 Land Use Plan Update

The Preferred Alternative would be expected to have no adverse effects on geology within Fort Belvoir's Main Post and EPG. The geology of the area remains unchanged regardless of the small portions of bedrock underlying the area that could be affected by construction activities. Such effects would be inconsequential and localized.

4.6.2.1.2 BRAC Implementation and Facilities Projects

Implementing the BRAC action and other facilities projects would be expected to have no adverse effects on geology within Fort Belvoir's Main Post and EPG. The NGA and WHS campuses and joint parking structure would be located on the EPG within the Coastal Plain Physiographic Province geologic materials. Since these materials are unconsolidated, excavation for foundations and utilities would be simple and not require blasting. Crossings of Accotink Creek would involve geology of the Piedmont Upland Physiographic Province and could require drilling or small amounts of blasting to manipulate the bedrock features adjacent to the creek. Overall, the geology of the area would remain unchanged, although small portions of the bedrock underlying the area could be directly affected by these construction activities. These effects would be inconsequential and localized.

4.6.2.3 Soils

4.6.2.3.1 Land Use Plan Update

Effects to soils are typically assessed by the nature and extent of disturbance that would occur to the resource under the different scenarios. In this case, changes in land use plans do not define the extent of effects that would result if the plan were implemented. Instead, the land use plans define the types of activities that could occur within the various land use categories. The Preferred Alternative land use plan would not include an Environmentally Sensitive category that is part of the 1993 plan and instead incorporates those areas into, Community, Residential, and Professional/Institutional land use categories. Therefore, under the Preferred Alternative land use plan, the potential for development in a wider range of areas is possible than under the 1993 plan. Construction activities, the largest potential source of impacts on the soil resource would require the standard erosion and sediment control, standard engineering practices, and stormwater control measures that are designed to minimize the loss of soils from erosion and sediment.

Soil types that could support prime farmlands occur within the project area. However, since the lands within Fort Belvoir are in urban use or otherwise irreversibly committed to other uses, the prime farmland designation does not apply.

4.6.2.3.2 BRAC Implementation and Facilities Projects

Minor short- and long-term adverse effects to soils would be expected under the Preferred Alternative as a result of construction activities. The extent of disturbance that would be expected provides the most direct measure of determining the extent of impacts to the soil resource. Because some of the soils within the Main Post and EPG have already been impacted by previous construction and land clearing activities, not all soils within the project area are in their undisturbed state and at maximum productivity. The raw acreage values of *new* disturbance, therefore, overestimate the extent of impacts that would occur. Regardless, the extent of new disturbance provides a reasonable basis for comparison.

Under the Preferred Alternative, development activities would be distributed between the Main Post and EPG. While some degree of development and land disturbance has occurred within EPG during its years as a training facility, the area has less existing development than the areas on the Main Post. Therefore, it would undergo a greater extent of impact to previously undisturbed soils. The total amount of new disturbance that would result by implementing the BRAC action along with other facilities projects would be approximately 353 acres. Table 4.6-3 presents the extent of new disturbance that would occur under each alternative and the areas where development activities would be concentrated.

Table 4.6-3
Acreage of soil impact (disturbance footprint) under each alternative

Alternative	Acres impacted	Main area(s) of disturbance
Preferred	353	Primarily South Post and EPG; North Post to a lesser extent
Town Center	330	North Post, South Post
City Center	298	EPG and GSA (North and South Post to a lesser extent)
Satellite Campuses	471	Primarily North Post; South Post to a lesser extent

Disturbances would affect soil resources in a number of ways. In some cases, topsoil would be stripped from a site before the placement of pavement of building foundations. Productivity of stripped soils would be completely lost because vegetation would be unable to grow in the new impervious areas. The process of excavating trenches for pipelines and power lines would result in a loss of soil structure and a mixing of horizons (layers) that develop over time. While these soils are often placed back into the excavated areas, the mixing of the soils results in a long-term loss of productivity and presents the potential for erosion until vegetation is reestablished. Erosion would be minimized by using standard construction BMPs and the loss of productivity within managed landscapes could be overcome by applying fertilizer.

Under the Preferred Alternative, development activities would be distributed between the Main Post and EPG. Much of the EPG, particularly the eastern portion has been disturbed through training and testing activities. Natural vegetation has become reestablished in a number of these areas and many of the soils disturbed 1940s and 1950s will have started to redevelop the structure and biological activity. The biological activity would result in an increase in productivity over similar soils that were more recently disturbed, although the productivity levels would not be equivlanet to that of native soils.

Table 4.6-4 presents the primary soil types that would affected by each of the proposed BRAC projects. The majority of the areas proposed for development of the NGA and WHS facilities consist of either Urban or Cut and Fill soil types. On the main post, the DeWitt Army Community Hospital and the NARMC HQ building would be built on Beltsville, Metapeake and Mattapex soil types while the majority of other projects would occur on Urban soils. Urban and Cut and Fill soils are not naturally occurring soils and have suffered a loss in productivity as a result in a loss of structure and horizonation (layering). Beltsville, Matapeake, and Mattapex soils are considered highly erodible, sediment and erosion control measures would be required under the Commonweatlh's stormwater program to minimize effects. Mattapex's characteristic of being marginal for foundations could be overcome with standard engineering practices.

Development of roads and infrastructure would result in impacts across a wider range of soil types. Infrastructure improvements would include the installation of 157,000 liner feet of water and wastewater lines ranging up to 24 inches in diameter. These lines would require temporary disturbance of the soil resource during the process of excavation and burial. These direct impacts would be minor and short term (days to weeks) with the attendant loss in productivity being a minor but more long term (months to years) indirect effect. Electrical service lines would require an additional 93,750 linear feet of trenching and backfill, which would result in similar impacts. Approximately 92 acres of existing soils would be cleared in the process of developing new roads; the productivity of the soils under the newly paved surfaces would be permanently lost.

Table 4.6-4
Soil types impacted by proposed BRAC projects under the Preferred Alternative

Map Number	BRAC Facility	Soil Types Impacted
1	NGA Facility	Cut/Fill, Quantico
2	WHS Facility	Cut/Fill
3	MDA Facility	Urban
4	DeWitt Hospital	Beltsville, Mattapex
5	Dental Clinic	Urban
6	NARMC HQ Building	Beltsville, Matapeake
7	Corps of Engineers Integration Office	Cut/Fill
8	Infrastructure	Various
9	Emergency Services Center	Cut/Fill
10	Network Ops – PEO EIS	Urban
11	USANCA Support Facility	Urban
12	Child Development Center (NGA)	Urban
13	Child Development Center	Cut/Fill
14	Administrative Facility	Urban
15	Access Control Point	Urban
16	AMC Relocatables	Urban
17	PEO EIS Administrative Facility	Urban
18	Structured Parking Facility	Urban
19	Modernize Barracks	Urban
20	MWR Family Travel Camp	Urban

Road construction would also require the construction of one new bridge over Accotink Creek which would also result in direct impacts to soils associated with the construction of piers and footings. These effects would be permanent but localized. Infrastructure would also include the installation of approximately 25,000 linear feet of perimeter fencing, which would require clearing and grubbing of an area approximately 40 feet wide throughout the length of the fence. Impacts as a result of installing the fence would be short term although control measures (BMPs) would be necessary to ensure that erosion was minimized and the soils stabilized as quickly as possible following construction.

As noted above, soils that could support prime farmlands occur within the project area. Because the lands within Fort Belvoir are in urban use or otherwise irreversibly committed to other uses, the designation of prime farmland does not apply.

4.6.2.4 BMPs/Mitigation

4.6.2.4.1 Topography

Construction activities would result in changes to topography rather than impacts per se, since an increase or decrease in slope would not be beneficial or detrimental for topography in and of itself. Standard engineering practices, BMPs, and building codes have been developed and are employed to address construction in varying topographic conditions. Since there would be no impact on the resource, no specific mitigation measure for topography would be necessary.

4.6.2.4.2 Geology

Standard engineering practices and BMPs would be implemented to address construction-related issues stemming from local geology. Such practices could include appropriate design criteria (e.g. depth and location) for placement of footings and piers in preparation for building roads, bridges and foundations. None of the Alternatives would result in effects to the regional geology and localized effects would be minimal. Therefore, no specific mitigation measures would be necessary for this resource.

4.6.2.4.3 Soils

Fort Belvoir and the Virginia Department of Conservation and Recreation (VDCR) require that construction site operators minimize erosion by developing and implementing a site specific stormwater pollution prevention plan (SWPPP). The SWPPP describes BMPs and procedures to control erosion and sediment at the construction site. Because the Commonwealth of Virginia has already established requirements to limit soil erosion from construction sites, specific mitigation measures would not be required.

4.6.3 ENVIRONMENTAL CONSEQUENCES OF THE TOWN CENTER ALTERNATIVE

Implementing the Town Center Alternative would be expected to result in no effect on geology and result in short- and long-term minor adverse effects on topography and soils. A detailed description of the effects is presented below.

4.6.3.1 Topography

4.6.3.1.1 Land Use Plan Update

Development under either the 1993 land use plan or the Town Center Alternative land use plan would result in minor, localized long-term effects on topography resulting from construction activities.

The change in land use designations with the selection of the Town Center Alternative could produce more changes to topography than the 1993 land use plan because it would include EPG. The Town Center Alternative land use plan would remove the Environmentally Sensitive category that is part of the 1993 plan and incorporate those areas into Community, Residential, and Professional/Institutional land use categories. While development could potentially occur over a greater area, environmental constraints (e.g. jurisdictional wetlands) would retain their protected status and would continue to limit potential development in some of these areas. Effects to topography on the Main Post would likely be similar under both the Town Center Alternative and the 1993 land use plan and would, in either case, be minimal and localized.

4.6.3.1.2 BRAC Implementation and Facilities Projects

Similar to the Preferred Alternative, developing the Town Center Alternative would result in minor, localized, long-term effects on topography associated with construction activities. The Town Center Alternative would focus development on the North Post and South Post; therefore, construction of new roads within EPG would not be required. Because this alternative would avoid effects on EPG, changes in topography would be less than what would occur under the Preferred or City Center Alternatives.

4.6.3.2 Geology

4.6.3.2.1 Land Use Plan Update

Implementing the Town Center Alternative would be expected to have no adverse effects on geology. The geology of the area would remain unchanged regardless of the small portions of bedrock underlying the area that could be affected by construction activities. Such effects would be inconsequential and localized.

4.6.3.2.2 BRAC Implementation and Facilities Projects

Implementing the Town Center Alternative would be expected to have no adverse effects on geology within Fort Belvoir's Main Post and EPG. Under this alternative, none of the BRAC facilities would be located on the EPG; therefore all construction would occur within the Coastal Plain Physiographic Province. While construction could affect small portions of the unconsolidated bedrock materials, no blasting would be likely and the overall direct effects would be minimal.

4.6.3.3 Soils

4.6.3.3.1 Land Use Plan Update

Similar to the discussion under the Preferred Alternative above, the changes in land use between the Town Center land use plan and the 1993 land use plan do not define the extent of effects that would result in each case. Instead, the land use plans define the types of activities that could occur within the various land use categories. The 1993 land use plan includes the Environmentally Sensitive land use category. These lands have generally been reclassified as Professional/Institutional, Community, and Residential under the Town Center Alternative land use plan. While the potential exists for development to occur over a greater area under the proposed land use plan, environmental constraints (e.g. critical habitat) would retain their protected status and would continue to limit development in sensitive areas..

Soil types that could support prime farmlands occur within the project area. However, because the lands within Fort Belvoir are in urban use or otherwise irreversibly committed to other uses, the prime farmland designation does not apply.

4.6.3.3.2 BRAC Implementation and Facilities Projects

As discussed above, minor short- and long-term adverse effects to soils would be expected under any of the alternatives as a result of construction activities. Under the Town Center Alternative, development activities would be distributed between the North Post and South Post with no new development proposed for EPG. The total amount of new disturbance that would result by implementing Town Center Alternative would be approximately 330 acres (see Table 4.6-3). Table 4.6-5 presents the primary soil types that would be affected by each of the BRAC projects; the majority of development would occur on the Urban soil type with only the WHS facility and Child Development Center occurring primarily on Beltsville, Matapeake, and Mattapex soil types. As noted under the Preferred Alternative, while these soils are considered highly erodible, BMPs required under the Commonwealth of Virginia's stormwater regulations would minimize the extent of impacts. Infrastructure improvement, including water, sewer, and electrical lines would cross numerous soil types but only result in minor short- to long-term impacts as a result of disturbing soil profiles.

Table 4.6-5
Soil types impacted by proposed BRAC projects under the Town Center Alternative

Map Number	BRAC Facility	Soil Types Impacted
1	NGA Facility	Urban
2	WHS Facility	Beltsville, Matapeake
3	MDA Facility	Urban
4	DeWitt Hospital	Urban
5	Dental Clinic	Urban
6	NARMC HQ Building	Urban
7	Corps of Engineers Integration Office	Urban
8	Infrastructure	Various
10	Network Ops – PEO EIS	Urban, Dumfries
11	USANCA Support Facility	Urban
12	Child Development Center (NGA)	Urban
13	Child Development Center	Beltsville, Mattapex
14	Administrative Facility	Urban
15	Access Control Point	Urban
16	AMC Relocatables	Urban
17	PEO EIS Administrative Facility	Urban
18	Structured Parking Facility	Urban
19	Modernize Barracks	Urban
20	MWR Family Travel Camp	Urban

4.6.3.4 BMPs/Mitigation

BMPs would be similar to those for the Preferred Alternative (Section 4.6.2.4). Mitigation measures would not be required for topography, geology, and soils for reasons similar to those for the Preferred Alternative.

4.6.4 ENVIRONMENTAL CONSEQUENCES OF CITY CENTER ALTERNATIVE

Implementing the City Center Alternative would be expected to result in no effect on geology and result in minimal changes to topography. Short- and long-term minor adverse effects on soils would occur. A detailed description of the effects is presented below.

4.6.4.1 Topography

4.6.4.1.1 Land Use Plan Update

Development under either the 1993 land use plan or the City Center Alternative land use plan would result in minor, localized effects on topography associated with construction activities.

The change in land use designations with the selection of the City Center Alternative land use plan would produce more impacts than the 1993 land use plan because of the development, particularly roadways, that would be allowed on EPG. The recharacterization of lands designated

as Environmentally Sensitive under the 1993 land use plan to Professional/Institutional, Community, and Residential land use designations would allow development that was not considered in the 1993 land use plan. The City Center Alternative also designates the GSA Parcel as Professional/Institutional, which would allow development of new facilities; however, the extent of development already existing at the site would suggest minimal if any changes in the topography. Effects on topography on the Main Post would likely be similar under both the City Center Alternative and the 1993 land use plans and would, in either case, be minimal and localized.

4.6.4.1.2 BRAC Implementation and Facilities Projects

Similar to the Preferred Alternative discussion above, development under the City Center Alternative would result in long-term minor changes to topography associated with construction activities.

Because the City Center Alternative would focus development on EPG and to a lesser extent on the North Post and South Post, extensive construction, including new roads and utilities, would be required within EPG and the GSA Parcel. While still localized and inconsequential, the City Center Alternative would likely have the greatest extent of effects on topography compared to the others.

4.6.4.2 Geology

4.6.4.2.1 Land Use Plan Update

Implementing the City Center land use plan would have no effects on geology within Fort Belvoir's Main Post, EPG, or the GSA Parcel. The geology of the area would remain unchanged regardless of the small portions of bedrock underlying the area that could be affected by construction activities. Such effects would be inconsequential and localized.

4.6.4.2.2 BRAC Implementation and Facilities Projects

The City Center Alternative would be expected to have no effects on geology within Fort Belvoir's Main Post, EPG, or the GSA Parcel. The geology of the area would remain unchanged regardless of the small portions of bedrock underlying the area that could be affected by construction activities. Such effects would be inconsequential and localized and be similar to those discussed under the Preferred Alternative (Section 4.6.2.2.2).

4.6.4.3 Soils

4.6.4.3.1 Land Use Plan Update

As discussed previously, the changes in land use between the City Center land use plan and the 1993 land use plan do not define the extent of effects that would result in each case, only the types of activities that would be permitted. As noted above, the 1993 land use plan includes an Environmentally Sensitive category that is not carried through the City Center Alternative land use plan, rather, these lands would be recharacterized as Professional/Industrial, Community, and Residential. As noted above, environmental protections would remain in place for a portion of these areas (e.g. jurisdictional wetlands).

Soil types that could support prime farmlands occur within the project area. However, because the lands within Fort Belvoir are in urban use or are otherwise irreversibly committed to other uses, the prime farmland designation does not apply.

4.6.4.3.2 BRAC Implementation and Facilities Projects

As discussed above, implementing any of the Alternatives would be expected to result in minor long-term and short-term effects on soils as a result of construction activities. Under the City Center Alternative, development activities would be concentrated on EPG and, to a much lesser extent, in the North Post and South Post. The total amount of new disturbance that would result by implementing City Center Alternative would be approximately 298 acres (see Table 4.6-3), most of which would be concentrated on EPG. The soil types that would be affected by this alternative are presented in Table 4.6-6. Note that all BRAC development on the Main Post would occur on soils classified as Urban. Most development on EPG would occur on soils characterized as Urban or Cut and Fill, although part of the NGA facility would be built on Quantico soils. Infrastructure, including roads, water lines, sewer lines and buried electrical lines would affect a wide range of soil types resulting in minor short- to long-term losses in soil productivity where pipelines were buried and a permanent loss where soils were converted to impervious surfaces. The loss of soils in these relatively small areas would be minor. This alternative would also require the relocation of facilities to the GSA Parcel. Because that site consists primarily of buildings and other impervious surfaces, the effect on the soil resource in that parcel would be negligible.

Table 4.6-6
Soil types impacted by proposed BRAC projects under the City Center Alternative

Map Number	BRAC Facility	Soil Types Impacted
1	NGA Facility	Cut/Fill, Quantico
2	WHS Facility	Urban
3	MDA Facility	Cut/Fill
4	DeWitt Hospital	Cut/Fill
5	Dental Clinic	Urban
6	NARMC HQ Building	Cut/Fill, Beltsville
7	Corps of Engineers Integration Office	Cut/Fill
8	Infrastructure	Various
9	Emergency Services Center	Cut/Fill
10	Network Ops – PEO EIS	Cut/Fill
11	USANCA Support Facility	Urban
12	Child Development Center (NGA)	Cut/Fill
13	Child Development Center	Urban
14	Administrative Facility	Urban
15	Access Control Point	Urban
16	AMC Relocatables	Urban
17	PEO EIS Administrative Facility	Urban
18	Structured Parking Facility	Urban
19	Modernize Barracks	Urban
20	MWR Family Travel Camp	Urban

4.6.4.4 BMPs/Mitigation

BMPs would be similar to those for the Preferred Alternative (Section 4.6.2.4). Mitigation measures would not be required for topography, geology, and soils for reasons similar to those for the Preferred Alternative.

4.6.5 ENVIRONMENTAL CONSEQUENCES OF THE SATELLITE CAMPUSES ALTERNATIVE

Implementing the Satellite Campuses Alternative would be expected to result in no effect on geology and short- and long-term minor adverse effects on topography and soils. A detailed description of the effects is presented below.

4.6.5.1 Topography

4.6.5.1.1 Land Use Plan Update

Development under either the 1993 land use plan or the Satellite Campuses Alternative land use plan would result in long-term minor, localized effects on topography associated with construction activities.

The change in land use designations with the selection of the Satellite Campuses land use plan could produce slightly higher levels of effects than the 1993 land use plan since it would include EPG. The recharacterization of lands designated as Environmentally Sensitive under the 1993 land use plan to Professional/Institutional, Community, and Residential land use designations would allow development that was not considered in the 1993 land use plan. Development would be limited in areas with environmental constraints (e.g. critical habitat) because these areas would retain their protected status regardless of the land use designation; however changes in topography could occur over a broader area under the Satellite Campuses Alternative land use plan. Changes in topography on the Main Post would likely be similar under both land use plans and would, in either case, be minimal and localized.

4.6.5.1.2 BRAC Implementation and Facilities Projects

Similar to the discussions above, development under the Satellite Campuses Alternative would result in minor, localized changes in topography associated with construction activities.

The Satellite Campuses Alternative would focus development on the North and South Posts. Because this alternative would avoid effects on EPG, it would result in less change to topography than the Preferred or City Center Alternatives.

4.6.5.2 Geology

4.6.5.2.1 Land Use Plan Update

Implementing the Satellite Campuses land use plan would have negligible effects on geology within Fort Belvoir's Main Post and EPG. The geology of the area would remain unchanged regardless of the small portions of bedrock underlying the area that could be affected by construction activities. Such effects would be inconsequential and localized.

4.6.5.2.2 BRAC Implementation and Facilities Projects

Implementing the Satellite Campuses Alternative would be expected to have negligible effects on geology within Fort Belvoir's Main Post and EPG. The geology of the area would remain unchanged regardless of the small portions of bedrock underlying the area that could be affected by construction activities. Such effects would be inconsequential and localized and be similar to those discussed under the Preferred Alternative (Section 4.6.2.2.2).

4.6.5.3 Soils

4.6.5.3.1 Land Use Plan Update

The changes in land use between the Town Center land use plan and the 1993 land use plan define the types of activities that could occur within the various land use categories. As noted above, the 1993 land use plan includes an Environmentally Sensitive category that is not carried through the Satellite Campuses Alternative land use plan, rather, these lands would be recharacterized as Professional/Industrial, Community, and Residential. As noted above, environmental protections would remain in place for a portion of these areas (e.g. jurisdictional wetlands).

Soil types that could support prime farmlands occur within the project area. However, because the lands within Fort Belvoir are in urban use or are otherwise irreversibly committed to other uses, the prime farmland designation does not apply.

4.6.5.3.2 BRAC Implementation and Facilities Projects

Implementing any of the Alternatives would likely result in effects to soils as a result of construction activities. Under the Satellite Campuses Alternative, development activities would be distributed between the North Post and South Post with no new development proposed for EPG. This alternative would include the development of multiple facilities on the North Post golf coarse, which is an area where soils, if not in their native condition, are still highly productive. New development at Davison Army Airfield would not be expected to result in impacts to soils because this area was previously disturbed. Implementing Satellite Campuses Alternative would result in the greatest potential effect on soil resources of any of the alternatives (approximately 471 acres, see Table 4.6-3). Table 4.6-7 presents the primary soil types that would be affected by each of the BRAC projects; the majority of development would occur on the Urban soil type. with only the, DeWitt Hospital and the NAMRC HQ Facility would be built on Mattapex and Lunt soils. The PEO EIS Network Operations would be built on Sassafras and Bertie soils and the PEO EIS Administrative Facility would be built on Beltsville soils. Beltsville, Mattapex, and Bertie soil types are considered highly erodible although BMPs required under the Commonwealth of Virginia's stormwater regulations would minimize the extent of impacts. Soils with shrink/swell or other undesirable characteristics for construction would be addressed using standard engineering practices. Infrastructure improvement, including water, sewer, and electrical lines would cross numerous soil types but only result in minor short- to long-term impacts as a result of disturbing soil profiles. A permanent loss of the soil resource would occur where soils were covered with impervious surfaces; in these cases, the impacts would be minor and localized.

Table 4.6-7
Soil types impacted by proposed BRAC projects under the Satellite Campuses Alternative

Map Number	BRAC Facility	Soil Types Impacted
1	NGA Facility	Cut/Fill
2	WHS Facility	Urban
3	MDA Facility	Urban
4	DeWitt Hospital	Mattapex
5	Dental Clinic	Urban
6	NARMC HQ Building	Mattapex, Lunt
7	Corps of Engineers Integration Office	Urban
8	Infrastructure	Various
10	Network Ops – PEO EIS	Sassafras, Bertie
11	USANCA Support Facility	Urban
12	Child Development Center (NGA)	Urban
13	Child Development Center	Urban
14	Administrative Facility	Urban
15	Access Control Point	Urban
16	AMC Relocatables	Urban
17	PEO EIS Administrative Facility	Beltsville
18	Structured Parking Facility	Urban
19	Modernize Barracks	Urban
20	MWR Family Travel Camp	Urban

4.6.5.4 BMPs/Mitigation

BMPs would be similar to those for the Preferred Alternative (Section 4.6.2.4). Mitigation measures would not be required for topography, geology, and soils for reasons similar to those for the Preferred Alternative.

4.6.6 ENVIRONMENTAL CONSEQUENCES OF THE NO ACTION ALTERNATIVE

The No Action Alternative would not affect the local geology but would be expected to result in short- and long-term minor adverse effects on topography and soils. A detailed description of the effects is presented below.

4.6.6.1 Topography

Under the No Action Alternative, the 1993 land use plan would remain in place. Under this plan, the existing land use designations would continue to allow construction activities that could result in minor changes to topography. There would be no changes to land use designations and no development would occur at EPG or the GSA Parcel.

4.6.6.2 Geology

The No Action Alternative would be expected to have negligible effects on geology within Fort Belvoir's Main Post and none at EPG or the GSA Parcel. The geology of the area would remain

unchanged regardless of the small portions of bedrock underlying the area that could be affected by construction activities that would occur under the current 1993 land use plan. Such effects would be localized and inconsequential.

4.6.6.3 Soils

The continued use of the 1993 land use plan would allow future development to occur throughout the Main Post governed by future needs and the existing land use categories. The 1993 land use plan identifies 4,531 acres in Environmentally Sensitive, Training Range, and Outdoor Recreation land use types. Soil disturbances within these land use categories would be less extensive than in the other land use categories. Impacts on soil resources would be limited in size and minor in severity.

Soil types that could support prime farmlands occur within the project area. However, because the lands within Fort Belvoir are in urban use or otherwise irreversibly committed to other uses, the prime farmland designation does not apply.

4.6.7 SUMMARY OF COMPARISON OF ALTERNATIVES

4.6.7.1 Topography

Implementing any of the alternatives would be expected to result in minor changes in topography. The construction of buildings and infrastructure would result in alterations in topography under each Alternative. These activities would be more like to alter previously unaffected land under the Preferred Alternative and City Center Alternative land use plans because these would focus most new development on EPG. Changes to topography under all alternatives would generally result where the cut and fill approach is used to level areas for roads and buildings. While the degree of impact on topography would be greater under the Town Center and Satellite Campuses Alternatives, the overall effect would still be insignificant.

4.6.7.2 Geology

Implementing any of the alternatives would have negligible effects on geology within Fort Belvoir's Main Post and EPG. The geology of the area would remain unchanged, although small portions of the bedrock underlying the area could be affected by construction activities. Such effects would be inconsequential and localized.

4.6.7.3 Soils

Short and long term effects to soils' productivity would occur under all the alternatives resulting from construction activities and the installation of impervious surfaces. These effects would be minor when considered on the landscape level. Soils covering many areas within the Main Post and EPG that are amenable to construction have already been subject to previous construction and land-clearing activities; therefore, not all soils within the project area are in their undisturbed state and at maximum productivity (e.g. Urban and Cut and Fill). With the acres of disturbance being the simplest measure to compare alternatives, the Preferred Alternative and City Center Alternative land use plans would affect 353 and 298 acres of soils, respectively, concentrated primarily in EPG. Construction proposed under the City Center Alternative would affect the lowest amount of native soils, with most development planned to occur on Urban or Cut and Fill soil types. The Satellite Campuses Alternative would result in the greatest extent of disturbance (471 acres) with disturbances occurring primarily in the North Post. The Town Center

Alternative land use plan would affect 330 acres on the North Post and South Post. Under all alternatives, soil erosion arising from construction activities would be minimized using a standard set of BMPs applied throughout the construction process. Soils characteristics that are not well suited to construction (e.g., shrink/swell, shallow groundwater) can be overcome with standard engineering practices and would not contribute to direct or indirect effects as long as the characteristics were taken into consideration.

4.7 WATER RESOURCES

Water resources on Fort Belvoir are described in the following section under major topics that include watershed characterization, surface water quality, pollutant sources, groundwater, and other water resources policies. Potential effects on water resources as a result of the proposed action and alternatives are also described.

4.7.1 AFFECTED ENVIRONMENT

4.7.1.1 Watershed Characterization

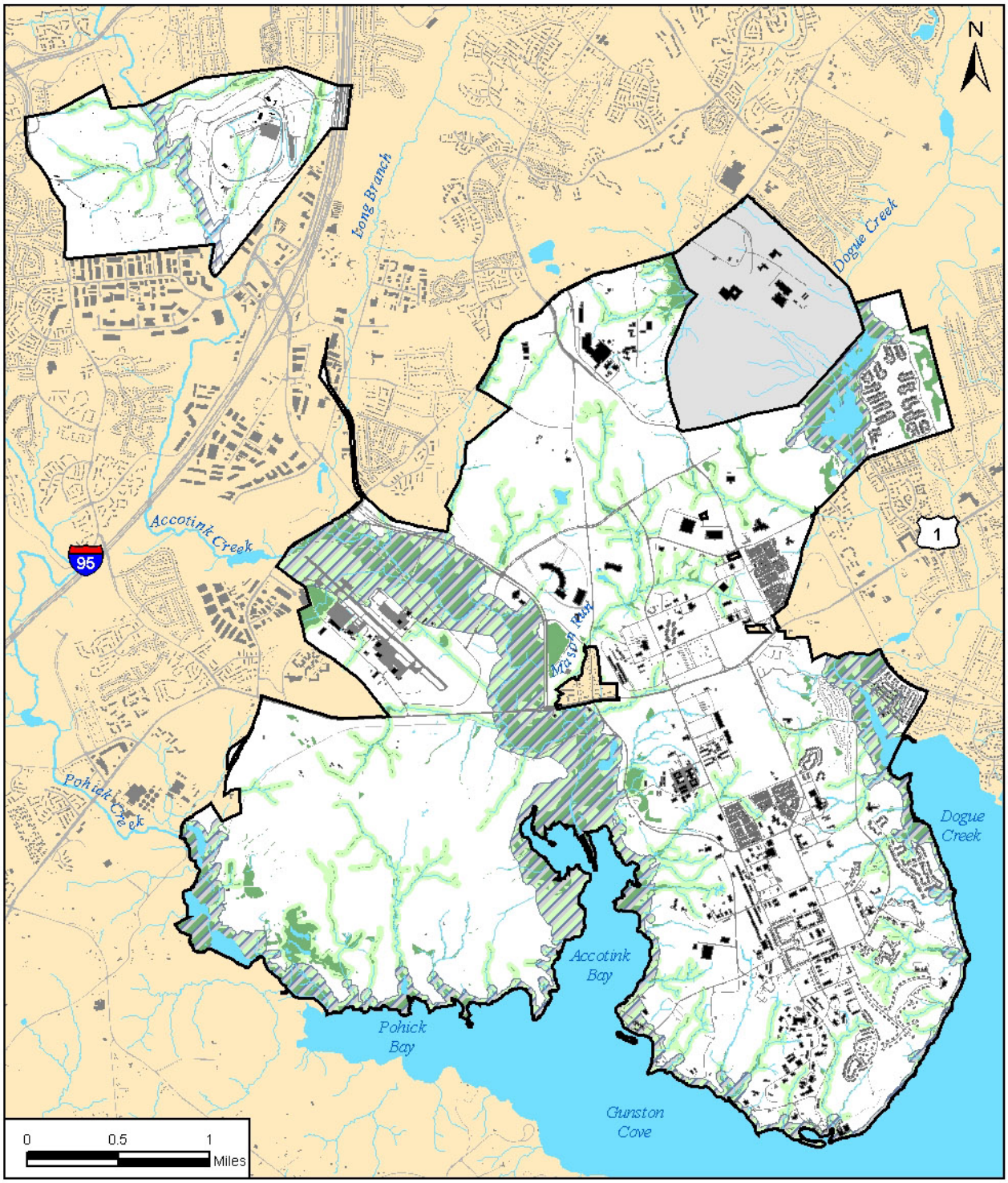
Fort Belvoir is located along the Potomac River, which is the second largest tributary to the Chesapeake Bay. Surface water from Fort Belvoir drains directly to the Potomac River and to the lower reaches of three major Potomac River tributaries: Pohick Creek, Accotink Creek, and Dogue Creek (Figure 4.7-1). The headwaters of these tributaries are off-post to the north and west of Fort Belvoir in Fairfax County, Virginia. The headwaters of Mason Run (tributary to Accotink Creek) and several unnamed tributaries are located within the installation. Fort Belvoir's EPG is a large training area that is located just northwest of the Main Post, across I-95. EPG is located entirely within the Accotink Creek watershed. Accotink Creek flows southward through EPG and the Main Post, before emptying into Accotink Bay. The Main Post is bounded by Pohick Creek (which flows into Pohick Bay) to the southwest and Dogue Creek along the installation's eastern boundary. Pohick Bay and Accotink Bay combine to form Gunston Cove along the southern tip of the Main Post.

Fort Belvoir includes approximately 105.5 stream miles, of which 28 miles are perennial and 31.1 miles are intermittent. Ephemeral streams (channels that have water only during or following storm events) comprise 1.9 miles, and other storm water conveyances total 44.5 miles on the installation (Fort Belvoir, 2004). Stream classifications and mileage were determined for Resource Protection Area (RPA) planning purposes and are subject to change as Fort Belvoir streams are evaluated in the field using Fairfax County's perennial streams assessment protocol during project planning. Three manmade ponds and numerous groundwater seeps are also present on the installation (Fort Belvoir, July 2002). Additional information on wetlands and other biological resources is discussed in Section 4.8.

4.7.1.1.1 Watersheds and Subwatersheds

The watersheds of Fort Belvoir are part of the Middle Potomac-Anacostia-Occoquan hydrologic unit. A hydrologic unit is a geographic area that represents all or part of a surface drainage basin, combination of drainage basins, or a distinct hydrologic feature. The U.S. Geological Survey (USGS) designated Hydrologic Unit Code (or HUC) for this watershed is 02070010. HUCs were established by the USGS to identify U.S. watersheds and their subwatersheds using a standardized numeric classification system. USGS hydrologic units are arranged into four levels of progressively smaller watershed divisions and subdivisions, which are identified by a series of 2-digit (largest area) to 8-digit (smallest area) HUCs. Efforts are underway to catalog even smaller drainage subdivisions.

Fort Belvoir is drained by seven watersheds that contribute to the Potomac River and, ultimately, the Chesapeake Bay. During development of the Fort Belvoir Integrated Natural Resources Management Plan (INRMP), these seven watersheds were divided into 53 subwatersheds for the



LEGEND

- Installation Property
- 100-Year Flood Zone
- Wetland
- Resource Protection Area

Sources: Fort Belvoir GIS, 2006; Fairfax County GIS, 2006.

Water Resources

Fort Belvoir, Virginia

Figure 4.7-1

purposes of characterizing the installation's waterbodies, identifying existing issues, and recommending solutions (Horne, 2001). The subwatershed that includes EPG (53) was divided into seven smaller subwatersheds: 53A–53G. These subwatersheds were subsequently re-numbered (53–59) in the current Fort Belvoir watersheds GIS coverage (Fort Belvoir GIS, 2006). Figure 4.7-2 shows the seven primary watersheds and the 59 numbered subwatersheds. Table 4.7-1 presents summary statistics for the seven watersheds that encompass Fort Belvoir.

Accotink Creek, Dogue Creek, and Pohick Creek drain most of Fort Belvoir. These streams also drain much of eastern Fairfax County. This area of Fairfax County, particularly within the Accotink Creek watershed, is primarily urban and suburban in character and is approximately 80 percent developed north and west of the installation. The remaining four watersheds—Accotink Bay, Gunston Cove, Pohick Bay, and Potomac River—represent areas on Fort Belvoir that directly drain to these waterbodies (Horne, 2001).

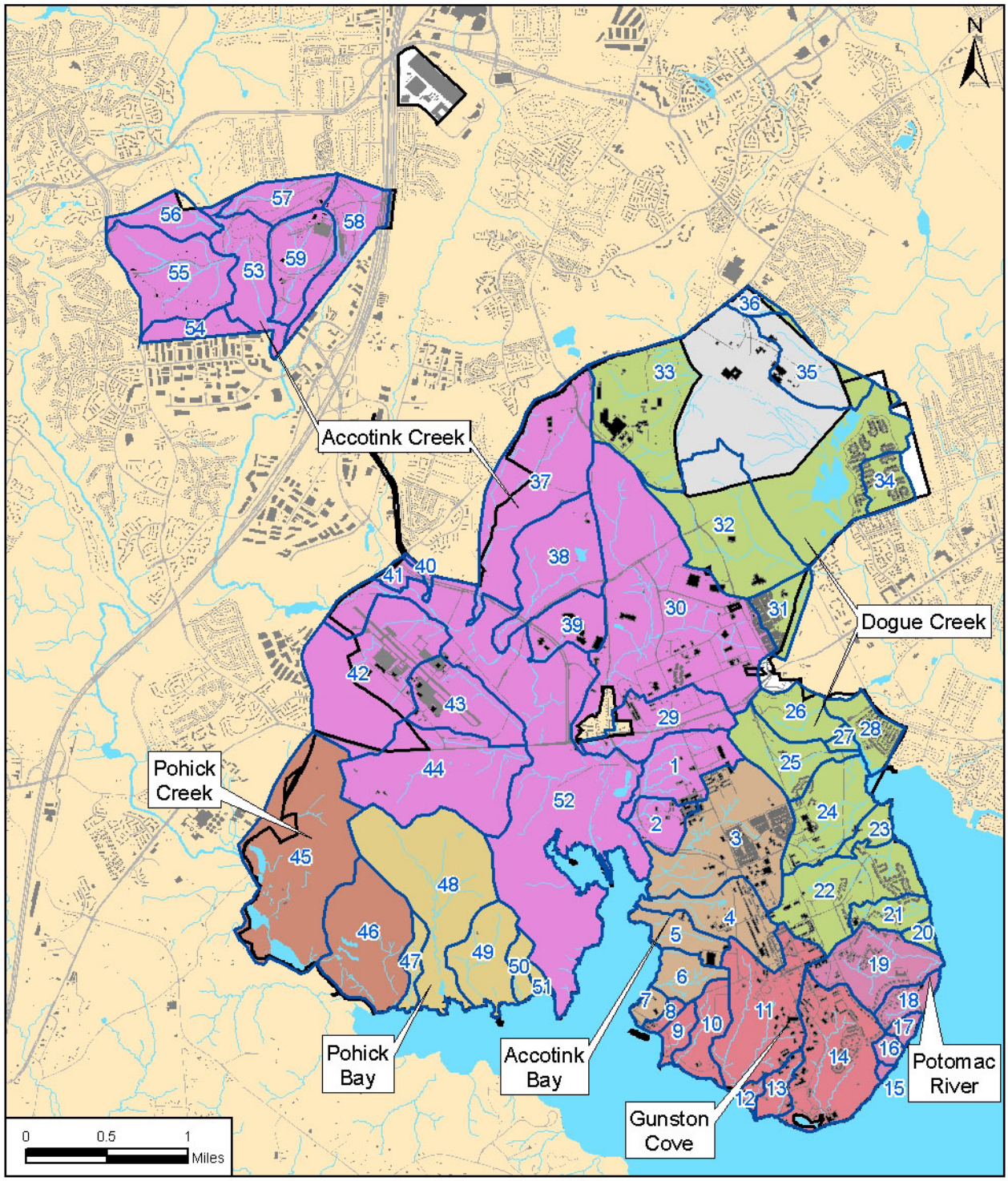
The largest watershed on the installation, Accotink Creek, covers approximately 48 percent of the installation (including EPG) and contains 20 subwatersheds (Horne, 2001; Fort Belvoir GIS, 2006). EPG is entirely within the Accotink Creek watershed and is divided into seven subwatersheds. The Main Post includes the remaining 13 Accotink Creek subwatersheds.

The Dogue Creek watershed covers approximately 20 percent of Fort Belvoir and is divided into 15 subwatersheds. The remaining five watersheds contain between two and seven subwatersheds each. Pohick Creek and Gunston Cove each covers roughly 8 percent of the installation. Accotink Bay and Pohick Bay each covers 7 percent of the installation. The Fort Belvoir INRMP (Horne, 2001) and the Fort Belvoir *Watershed Delineation Project Update* (Landgraf, 2003) provide additional background information on development conditions in the Fort Belvoir watersheds and subwatersheds.

The Fort Belvoir INRMP commits Fort Belvoir to follow a watershed approach to land management that acknowledges the relationship of land use and upstream areas with downstream resources (Horne, 2001). The Virginia Coastal Zone Management Act (CZMA) and Chesapeake Bay initiatives, discussed in Section 4.7.1.5, establish far-reaching, natural resources protection policies, strategies, and actions for landholders to undertake throughout the Chesapeake Bay watershed. The DoD and the Army are signatory agencies to the agreements and have incorporated watershed and tributary protection strategies into the master plan and other installation policies.

4.7.1.1.2 Flows and Exchanges

The USGS has historically maintained stream flow gauges at locations throughout the Potomac-Anacostia-Occoquan watershed. USGS gauges have measured stream flow on the Potomac River, Pohick Creek, Accotink Creek, Piney Run, and Dogue Creek. Historical flow records were analyzed to determine the range of flow conditions and average stream flows. The nearest active USGS stream gage is Station 01654000 on Accotink Creek, approximately 5 miles upstream from the northern perimeter of EPG and upstream of Lake Accotink in Annandale, Virginia. This station monitors a 24 square mile watershed and has been in operation since 1947. Daily average flow recorded at this station is 28.4 cubic feet per second (cfs). The mean monthly flow between October 1947 and September 2004 ranged from 18.1 cfs in October to 42.3 cfs in March. The minimum monthly flow recorded over this period was 0.45 cfs in September 1954, and the maximum monthly flow recorded over the period was 125 cfs in May 1989.



Fort Belvoir Subwatersheds

Fort Belvoir, Virginia

Sources: Fort Belvoir GIS, 2006; Fairfax County GIS, 2006.

Figure 4.7-2

Table 4.7-1
Fort Belvoir Watersheds

Fort Belvoir watershed	Total watershed surface area (acres)	Percentage of total watershed area within Fort Belvoir	Surface Area within Fort Belvoir (acres)	Percent of Fort Belvoir land area	Number of subwatersheds within Fort Belvoir
Accotink Creek[a]	33,156	14	4,040	48	20
Dogue Creek	10,883	21	1,713	20	15
Pohick Creek	22,755	3	638	8	2
Gunston Cove	681	100	681	8	7
Accotink Bay	604	100	613	7	5
Pohick Bay[b]	569	100	571	7	5
Potomac River[b]	237	100	239	2	5
TOTAL			8495	100	59

Source: Horne, 2001; Fort Belvoir GIS, 2006.

[a]EPG is located entirely within the Accotink Creek watershed. The number of subwatersheds was updated to include the 7 re-numbered EPG subwatersheds

[b]Total watershed surface area shown represents acreage on Fort Belvoir only.

4.7.1.2 Surface Water Quality

4.7.1.2.1 Applicable Standards

The Virginia Department of Environmental Quality (VDEQ) defines surface water quality standards that protect designated uses for surface waters in Virginia. Water quality standards consist of three components: use designations, general and numeric water quality criteria necessary to protect those uses, and an antidegradation statement. Water quality standards have the dual purposes of establishing the water quality goals for specific waterbodies and serving as the regulatory basis for establishing water quality-based treatment controls and strategies beyond the technology-based levels of treatment required by sections 301(b) and 306 of the Clean Water Act (CWA). All streams in Virginia, including those flowing through Fort Belvoir, are minimally assigned the uses of recreation (e.g., swimming and boating); propagation and growth of a balanced, indigenous population of aquatic life, including game fish, which might reasonably be expected to inhabit them; wildlife; and the production of edible and marketable natural resources (e.g., fish and shellfish).

Virginia water quality standards contain general criteria statements and a wide range of numeric water quality criteria for pesticides and polychlorinated biphenyls (PCBs), VOCs, acid- and base-extractable organics, other organics, metals, pH, and inorganics, as well as conventional pollutants such as total dissolved solids. Table 4.7-2 lists numeric water quality criteria and fish tissue screening levels for constituents that are of particular interest on the basis of information contained in Virginia's 303(d) list of impaired waters for Fort Belvoir waterbodies (and receiving waters). Note that VDEQ is currently developing nutrient criteria for surface waters. Streams on Fort Belvoir are Class III nontidal waters, according to Virginia water quality standards. Tidal receiving waters including the Potomac River, Accotink Bay, Pohick Bay, and Gunston Cove are Class II waters. Virginia water quality criteria apply to Class II and Class III waters unless otherwise specified.

Table 4.7-2
Virginia water quality standards and fish tissue screening levels

General water quality parameters

Parameter	Units	Criteria
Water temperature—Class III nontidal waters[a]	ºC	32 (instantaneous maximum)
Dissolved oxygen–Class III nontidal waters	mg/l	4.0 (instantaneous minimum); 5.0 (daily average)
Dissolved oxygen—Class II tidal waters[b]	mg/l	30 day mean > 5.5 mg/l (tidal habitats with 0-0.5 ppt salinity); 30 day mean > 5 mg/l (tidal habitats with >0.5 ppt salinity); 7 day mean > 4 mg/l; Instantaneous minimum > 3.2 mg/l at temperatures < 29°C; Instantaneous minimum > 4.3 mg/l at temperatures > 29°C
pH	SU	6.0-9.0
Fecal coliform bacteria[c]	#/100 ml	200/400
E. coli[d]	#/100 ml	126/235
enterococci[e]	#/100 ml	35/104

Other parameters

Parameter	Units	Aquatic life—freshwater acute	Aquatic life—freshwater chronic	Human health—public water supplies	Human health—all other surface waters
Total PCBs (water)	µg/l	NA	NA	0.0017	0.0017
Total PCBs (fish tissue screening level)	ppb	NA	NA	54	54
Benzo(k)fluoranthene (water)	µg/l	NA	NA	0.044	0.49
Benzo(k)fluoranthene (fish tissue screening level)	ppb	NA	NA	15	15
Benzo(b)fluoranthene (water)	µg/l	NA	NA	0.044	0.49
Benzo(b)fluoranthene (fish tissue screening level)	ppb	NA	NA	15	15
Chrysene (water)	µg/l	NA	NA	0.044	0.49
Chrysene (fish tissue screening level)	ppb	NA	NA	15	15

[a]Temperature criteria are not specified for Class II tidal waters.

[b]Open Water criteria shown. For information on seasonal DO criteria for specific designated uses refer to Virginia Water Quality Standards 9 VAC 25-260-185 and for information on implementation of DO criteria for naturally low DO waters refer to 9 VAC 25-260-55.

[c]The Virginia fecal coliform bacteria standard for primary contact recreational waters is as follows: "Fecal coliform bacteria shall not exceed a geometric mean of 200 fecal coliform bacteria per 100 ml of water for two or more samples over a calendar month nor shall more than 10 percent of the total samples taken during any calendar month exceed 400 fecal coliform bacteria per 100 ml of water." For information on fecal coliform criteria for shellfish waters refer to Virginia Water Quality Standards 9 VAC 25-260-160.

[d]The Virginia *E. coli* standard for primary contact recreational waters (freshwaters) states that *E. coli* shall not exceed a geometric mean of 126 per 100ml for two or more samples over any calendar month and shall not exceed a single sample maximum of 235 per 100 ml.

[e]The Virginia enterococci standard for primary contact recreational waters (saltwater and transition zone) states that enterococci shall not exceed a geometric mean of 35 per 100ml for two or more samples over any calendar month and shall not exceed a single sample maximum of 104 per 100 ml.

In addition to Virginia's water quality standards, the Army's administrative publication, DA PAM 200-1, Environmental Protection and Enhancement, requires installations to conserve all water sources and protect them from contamination by developing and implementing plans to ensure a level of water quality that supports "the propagation of fish, shellfish and wildlife; recreation in and on the water; and the protection of drinking water sources."

4.7.1.2.2 Clean Water Act Section 303(d) Listing

Section 303(d) of the CWA requires states to identify and develop a list of waterbodies that are impaired and for which technology-based and other required controls have not resulted in attainment of water quality standards. Several waterbodies that flow through Fort Belvoir, or are immediately downstream, are listed on Virginia's 2004 303(d) list of impaired waters (VDEQ, 2004). Virginia also recently prepared the Draft 2006 303(d) list, which includes updated impairment information (VDEQ, 2006). Impaired segments within or adjacent to Fort Belvoir are listed in Table 4.7-3. The development of Total Maximum Daily Loads (TMDLs) is required for waterbodies that are included on the 303(d) list. TMDLs and load reductions are required for the pollutants of concern for each listed waterbody. VDEQ is currently developing TMDLs in accordance with the 10-year EPA consent decree schedule (for waterbodies originally listed on the 1998 303(d) list). A fecal coliform bacteria TMDL for Accotink Creek (portion upstream of Lake Accotink) was developed by VDEQ and approved by EPA in 2002.

4.7.1.2.3 In-Stream Water Quality

Current and historical water quality conditions of the watersheds of Fort Belvoir were determined using available VDEQ water quality data, Fairfax County Health Department data, EPA's STOrage and RETrieval (STORET) database information, the Fort Belvoir INRMP, and other Fort Belvoir documents. Water quality data collected at VDEQ stations within the vicinity of Fort Belvoir are presented in Table 4.7-4, and monitoring station locations are shown in Figure 4.7-3. VDEQ uses ambient water quality, sediment, fish tissue, and other available data to assess water quality conditions, threats to human health, and the impairment status for each waterbody (see Section 4.7.1.2.2). Data for selected water quality parameters collected from 1/1/1990 to 9/1/2006 were summarized to provide background information on water quality conditions for Fort Belvoir waterbodies.

The Fairfax County Health Department also samples several streams in the County and publishes the results in an annual report. Four stations are located in the immediate vicinity of Fort Belvoir, upstream from the installation on Pohick, Accotink, and Dogue Creeks. The Pohick Creek station (#17-08) is located just outside the installation boundary on Old Colchester Road. The Dogue Creek station (#15-06) is located just outside of the installation boundary upstream from George Washington Village. The two stations in the Accotink Creek watershed are on Long Branch (#16-13) just outside the installation boundary on the northern side of Telegraph Road and on Accotink Creek (#16-09) 5 miles upstream from Fort Belvoir. The stations are shown on Figure 4.7-3.

The results from the 2002 water quality report for fecal coliform, nitrate nitrogen, pH, and total phosphorus in these watersheds are presented in Table 4.7-5. For dissolved oxygen (DO), the farthest downstream stations in the Pohick watershed and on Long Branch in the Accotink watershed reported no DO levels under the minimum DO criterion of 4.0 mg/l in 2002. However, the Dogue Creek station reported that 29 percent of samples did not meet the minimum criterion, and the station farther upstream on Accotink Creek (#16-09) reported that 20 percent of samples did not meet the criterion (Fairfax County Health Department, 2003a).

Table 4.7-3
303(d) Listed waterbodies within or downstream of Fort Belvoir

303(d) listed waterbody	Extent	Use impaired	Impairment cause (initial list date)
Accotink Creek	Confluence of Calamo Branch downstream to end of free-flowing waters (8.62 miles)	Aquatic Life, Recreation	General Standard (Benthic)—(1996), Fecal Coliform (2004)
Pohick Creek	Confluence of South Run downstream to end of free-flowing waters (3.2 miles)	Fish Consumption, Recreation	Fish Tissue—PCBs, PAH (2002). PAH listing was for Benzo[k]fluoranthene. Benzo[b]fluoranthene and Chrysene also noted in 2002. *E. coli* (2006)
Dogue Creek	Tidal waters of Dogue Creek, extending from approximately rivermile 2.1 until the confluence with the Potomac River. Portion of CBP segment POTTF[a] (0.74 mi^2)	Fish Consumption, Recreation, Aquatic Life, Shallow-Water SAV[b]	Fish Tissue—PCBs (2002), Fecal Coliform (2006), Aquatic Plants (2006)
Accotink Bay	Tidal waters of Accotink Creek until the confluence with the tidal waters of Pohick Bay/Gunston Cove. Portion of CBP segment POTTF[a] (0.35 mi^2)	Fish Consumption, Aquatic Life, Shallow-Water SAV[b]	Fish Tissue—PCBs (2002), Aquatic Plants (2006)
Pohick Bay	Tidal waters of Pohick Creek, from the boundary of watershed A15, extending to rivermile 1.31 in Gunston Cove. Portion of CBP segment POTTF[a] (0.61 mi^2) Tidal waters of Pohick Creek upstream from the boundary of watershed A16. Portion of CBP segment POTTF[a] (0.29 mi^2)	Fish Consumption, Recreation, Aquatic Life, Shallow-Water SAV[b]	Fish Tissue—PCBs (2002), Fecal Coliform (2006), Aquatic Plants (2006) * Ammonia was also listed in 2002 for the upper segment but was not included on the 2006 list.
Gunston Cove	Segment extends from rivermile 1.31 in Gunston Cove until the confluence with the Potomac River. Portion of CBP segment POTTF[a] (1.51 mi^2)	Fish Consumption, Aquatic Life, Shallow-Water SAV[b]	Fish Tissue—PCBs (2002), Aquatic Plants (2006)

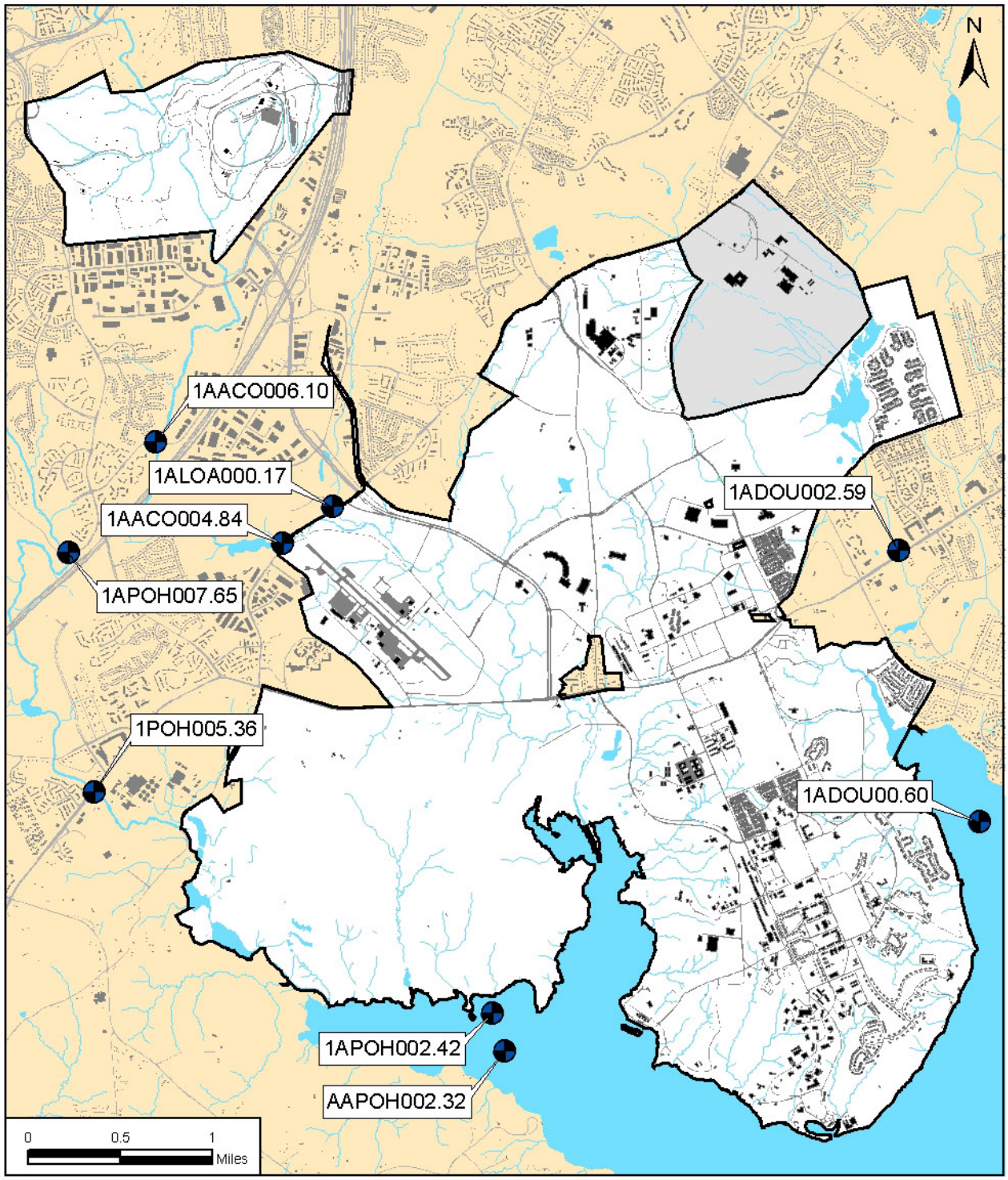
[a]POTTF refers to the Upper Potomac River segment of the Chesapeake Bay Program (CBP)
[b]Submerged Aquatic Vegetation.

The report also provided data for heavy metals. For the sampling period 1989 to 1998, the Pohick, Accotink, and Dogue Creek watersheds were all within the acceptable Primary Maximum Contaminate Levels (PMCLs) for arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver (Fairfax County Health Department, 2003a).

Water samples were also collected on Fort Belvoir in 1998 and 1999 as part of the installation's baseline aquatic survey (EA, 2000 as cited in Horne, 2001). Water samples were analyzed for nutrients, pesticides, metals, and total petroleum hydrocarbons on the installation's five main perennial waterways: Accotink Creek, Dogue Creek, Mason Run, and two unnamed tributaries. With the exception of aluminum, manganese, and iron, none of the analytes measured were at high levels. The EPA human health criteria for manganese and iron are based on prevention of

Table 4.7-4
Water quality summary for VDEQ stations near Fort Belvoir

Station ID	Data period	Statistic	Water quality data summary: pH (SU)	DO (mg/l)	Temp (degrees C)	*E. coli* (# colonies/ 100 ml)	Fecal Coliform (# colonies/ 100 ml)	Total N (mg/l)	Total P (mg/l)	TSS (mg/l)
Accotink Creek										
1ALOA000.17 (Long Branch, Trib. to Accotink Creek)	8/11/05–1/9/06	# samples	5	5	5	5	1	4	4	4
		Min	6.30	8.27	5.99	50	50	0.46	0.03	3
		Mean	6.8	10.30	13.67	415	50	0.62	0.04	8.75
		Max	7.38	12.95	27.66	1,600	50	0.80	0.06	24
1AACO004.84 (Telegraph Road)	8/11/05–1/9/06	# samples	5	5	5	5	1	4	4	4
		Min	6.79	8.26	4.11	25	50	0.69	0.01	3
		Mean	7.06	10.49	12.37	374	50	0.89	0.05	14.5
		Max	7.45	13.11	26.57	1,600	50	1.21	0.12	49
1AACO006.10 (Rt. #790)	10/17/90–6/13/01	# samples	102	99	108	-	102	-	110	109
		Min	6.17	6.00	0.80	-	18	-	0.01	1
		Mean	7.40	10.33	15.28	-	588	-	0.18	10.37
		Max	8.70	15.00	29.80	-	16,000	-	10.00	227
Pohick Creek										
1APOH005.36 (Rt. 1 bridge)	9/6/01–1/18/06	# samples	20	20	20	18	21	14	19	21
		Min	6.35	6.38	1.09	25	25	0.51	0.01	3
		Mean	7.29	10.70	13.90	325	431	0.84	0.03	15.04
		Max	8.21	15.75	25.36	2,000	2,000	1.51	0.05	188
1APOH007.65 (Rt. #642)	10/17/90–6/19/01	# samples	37	36	41	-	37	-	42	43
		Min	6.20	6.00	0.40	-	20	-	0.01	1
		Mean	7.18	10.81	13.48	-	360	-	0.09	7.18
		Max	8.00	14.00	26.70	-	3,600	-	0.07	75
Pohick Bay										
1APOH002.42 (Boat ramp, Rd 242)	8/15/02	# samples	1	1	1	-	-	-	-	1
		Value	9.17	8.80	29.07	-	-	-	-	7
1APOH002.32 (West side of Pohick boat ramp)	2/5/90–11/7/05	# samples	143	126	154	14	131	13	154	166
		Min	6.00	2.00	1.6	10	2	0.98	0.03	0
		Mean	7.71	9.62	19.01	75	254	2.37	0.15	21.37
		Max	10.00	16.00	32.50	400	8,000	4.36	3.90	68
Dogue Creek										
1ADOU002.59 (Rt. #1)	11/17/90–5/16/02	# samples	4	2	4	1	2	-	4	4
		Min	6.30	9.00	5.00	500	100	-	0.07	11
		Mean	6.66	11	8.25	500	125	-	0.12	22.75
		Max	6.99	13.00	17.70	500	150	-	0.20	31
1ADOU000.60 (Mt. Vernon Yacht Club)	2/5/90–11/7/05	# samples	117	108	127	14	121	13	134	133
		Min	6.00	6.00	0.50	10	2	0.95	0.01	0
		Mean	7.86	10.53	18.02	107.50	264	1.59	0.03	20.06
		Max	9.00	16.00	31.50	800	9,200	2.24	0.06	139



LEGEND

Installation Property

Water Monitoring Stations

Monitoring Stations

Fort Belvoir, Virginia

Sources: Fort Belvoir GIS, 2006; Fairfax County GIS, 2006.

Figure 4.7-3

Table 4.7-5
Fairfax County Health Department water quality sampling results for 1998-2002 for selected parameters in selected Fairfax County watersheds

Parameter	Criterion	Year	Pohick Creek[a]	Accotink Creek[b]	Dogue Creek[c]
Fecal coliform % of samples with < 200 colonies per 100 mg/l)	200 colonies/100 mg/l	1998	7	7	18
		1999	12	13	5
		2000	13	10	13
		2001	19	18	11
		2002	21	12	6
Nitrate nitrogen Geometric mean (mg/l)	10 mg/l	1998	0.3	0.5	0.2
		1999	0.3	0.6	0.2
		2000	0.3	0.5	0.1
		2001	0.3	0.5	0.2
		2002	0.3	0.4	0.2
pH Geometric mean	6.0–9.0	1998	7.1	7.2	6.9
		1999	7.2	7.3	6.9
		2000	6.9	7.0	6.8
		2001	6.9	7.0	7.0
		2002	6.8	6.9	6.7
Total phosphorus Geometric mean (mg/l)	No established criteria	1998	0.10	0.10	0.11
		1999	0.11	0.10	0.11
		2000	0.10	0.11	0.12
		2001	0.09	0.10	0.10
		2002	0.09	0.10	0.10

Source: Fairfax County Health Department, 2003a.
[a]Station #17-08, at Old Colchester Road
[b]Station #16-09, 5 miles upstream from Fort Belvoir
[c]Station #15-06, upstream from George Washington Village

objectionable taste and laundry staining, not adverse toxicological effects. The criterion for aluminum is based on long-term exposures for striped bass rather than humans and is frequently exceeded under natural conditions. The sampling results do not address contaminant inputs from storm flow conditions.

Accotink Creek, at 0.8 miles upstream from Fort Belvoir, was part of the USGS National Water-Quality Assessment (NAWQA) for the Potomac River Basin from 1992 to 1996 (USGS, 1998). The study concluded that concentrations of nutrients and pesticides in streams of the Potomac River Basin are among the highest in the nation, primarily as a result of urbanization. Habitat condition is one of the primary factors influencing biological condition in a waterway, and the

Accotink Creek site exhibited typical urban habitat degradation, including lower bank stability, increased bank erosion, and less riparian vegetation than less degraded sites. Pohick Creek and Dogue Creek, although not included in the NAWQA study, could be expected to have similar situations, though not as severe.

Of the three main Fort Belvoir watersheds, Dogue Creek, which contains most of the present housing areas on Fort Belvoir, is undergoing the most intensive development (Fort Belvoir, 2005b). However, the Huntley Meadows area, Jackson Miles Abbott Wetland Refuge in the upper reaches of Dogue Creek, and a chain of storm water ponds in Pohick Creek may help moderate storm water flows and biological condition by slowing storm flows and absorbing nutrients (Fort Belvoir, 2001).

4.7.1.3 Pollutant Sources

Pollutant sources are typically characterized as point or nonpoint sources under the CWA. Point sources, according to 40 CFR 112.3, are defined as any discernible, confined, and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, concentrated animal feeding operation, landfill leachate collection system, vessel, or other floating craft from which pollutants are or may be discharged. The National Pollutant Discharge Elimination System (NPDES) Program, under CWA Section 402, requires permits for the discharge of pollutants from point sources. VDEQ administers the NPDES program in Virginia, which is referred to as the Virginia Pollutant Discharge Elimination System (VPDES) Program. VDEQ also issues permits for dredge and fill activities that may affect wetlands and other State waters under the Virginia Water Protection (VWP) Permit Program. This program extends the state's authority over impacts to wetlands and other State waters granted under Section 401 (Water Quality Certification) of the CWA. The U.S. Army Corps of Engineers also regulates dredge and fill activities under Section 404 of the CWA. These permit programs and potential impacts to wetlands are discussed in more detail in Section 4.8 (Biological Resources).

Nonpoint sources are generally precipitation-driven and occur as overland flow carries pollutants, often attached to sediment, into streams. However, nonpoint sources may also include non-precipitation driven events such as contributions from groundwater, sanitary sewer systems, direct deposition of pollutants from wildlife and livestock, and atmospheric deposition. Nonpoint source pollution is managed under various federal, state, and local programs. Although storm water and associated pollutants are typically characterized as nonpoint source, Virginia regulates storm water runoff from urban areas as a point source, as described in the following section.

4.7.1.3.1 Point Sources

As mandated by the CWA and EPA's Phase I and Phase II storm water regulations, Virginia issues permits to dischargers of storm water from (1) industrial activities (including construction activities), and (2) municipal separate storm sewer systems (MS4s) under the VPDES program. There are several types of permits under the VPDES permit program, including permits issued for effluent from facilities; discharges from municipal wastewater treatment plants; storm water from industrial activities; storm water from construction sites; and storm water from urban MS4s. The VPDES storm water program responsibility is divided between VDEQ and the Virginia Department of Conservation and Recreation (VDCR). In January 2005, VPDES construction activity and MS4 storm water permitting responsibilities transferred from VDEQ to VDCR to become part of the Virginia Stormwater Management Program (VSMP) (VDCR, 2005; VDEQ,

2005b). The VDCR is responsible for the issuance, denial, revocation, termination, and enforcement of NPDES permits for the control of storm water discharges from MS4s and land disturbing activities under the Virginia Stormwater Management Program. The VDEQ continues to manage traditional wastewater point sources and other VPDES activities. Fort Belvoir has a VPDES Phase II Stormwater Permit (No. VAR040093) as a regulated small MS4 that expires in December 2007. In addition, the installation has a Phase I VPDES Industrial Stormwater General Permit (No. VAR051080) that specifically covers storm water runoff from Davison Army Airfield. Six additional storm water permits have been issued to the installation for storm water discharges associated with petroleum-contaminated sites, including a permit that was issued for remediation of the M-26 petroleum spill at EPG (Russell, 2005; Fort Belvoir, 2005b; USACE, 2003).

The VPDES Phase I permit program historically governed any construction activity including clearing, grading, and excavation activities, except for operations that result in the disturbance of an area less than 5 acres that is not part of a larger common plan of development or sale. The new Phase II VPDES program expands permit coverage to storm water discharges from construction activities affecting more than 2,500 square feet in areas that are considered to be within the Chesapeake Bay Preservation area (VDCR, 2005). All of Fort Belvoir is considered to be within the Chesapeake Bay Preservation area. The installation is currently developing and implementing pollution control measures in accordance with the standard permit conditions (Horne, 2001; Landgraf, 2003). Under Fort Belvoir's MS4 permit, construction plans and design documents must be submitted to DPW-ENRD for a technical review of new and redevelopment projects that disturb greater than or equal to 2,500 square feet of land surface to evaluate proposed storm water controls. Plans will be evaluated in accordance with the Virginia Erosion and Sediment Control Manual, the Virginia Stormwater Management (SWM) Handbook, and the Fairfax County Public Facilities Manual (PFM). Deficient or non-compliant documents will be returned to the designers for modification and resubmission prior to initiation of site work. Excavation permits will not be granted until plans are approved.

Pollution prevention for construction activities is addressed by VPDES Stormwater Permits for Construction Activities and Phase II MS4 permits as defined under the CWA, Virginia's Stormwater Management Act and Erosion and Sediment Control regulations, and by Army administrative publication DA PAM 200-1: Environmental Protection and Enhancement. VPDES general storm water permits require that Storm Water Pollution Prevention Plans (SWPPP) be developed and implemented. These plans identify potential sources of pollution, describe storm water control measures to be implemented, and ensure compliance with the permit. Virginia's SWM and Erosion and Sediment Control Acts require that, "properties and receiving waterways downstream of any land-development project shall be protected from erosion and damage due to increases in volume, velocity and peak flow rate of storm water runoff…in accordance with" minimum design standards as defined in Minimum Standard 19 of the Erosion and Sediment Control regulations or alternate design standards as defined in the Stormwater Management regulations. DA PAM 200-1 also requires installations to conserve all water sources and protect them from contamination by developing and implementing plans to ensure a level of water quality that supports "the propagation of fish, shellfish and wildlife; recreation in and on the water; and the protection of drinking water sources."

The Noman M. Cole, Jr. Pollution Control Plant, formerly known as the Lower Potomac Pollution Control Plant, is a wastewater treatment facility located about one half mile upstream from Fort Belvoir along Pohick Creek. This facility receives approximately half of Fairfax County's domestic and commercial wastewater flow and has a treatment capacity of 54 million

gallons per day (mgd) (Horne, 2001). The plant operates and discharges effluent into Pohick Creek under VPDES permit number VA0025364 . The plant achieves a 99 to 99.5 percent removal of suspended matter, organic substances, nutrients, infectious microorganisms, and other pollutants through its treatment processes (Fairfax County DPWES, 2001). However, water quality and flow conditions in the lower reach of Pohick Creek adjacent to Fort Belvoir may be influenced by discharges from the wastewater treatment plant (Horne, 2001).

4.7.1.3.2 Nonpoint Sources

Nonpoint sources may also contribute pollutants to downstream waterbodies and cause other impacts. Nonpoint sources represent contributions from diffuse, non-permitted sources. This does not include storm water from MS4 permitted areas, which is typically collected and discharged to surface waterbodies through an extensive storm water collection system. Storm water discharges and associated pollutants from these areas act as nonpoint sources, but are regulated as point sources.

Because of Fort Belvoir's administrative mission and the extent of development on the installation (approximately 30 percent of the installation is developed (USGS, 2001) and approximately 12 percent of the installation is covered with impervious surfaces (Horne, 2001)), the primary source of nonpoint pollution on Fort Belvoir is storm water runoff (Fort Belvoir, 2005b). Activities such as clearing vegetation or grading, removing and compacting soils, as well as extensive uses of impervious surfaces could increase the amount of storm water runoff in a watershed and result in pollutant contamination. Increased storm water runoff could cause increased flooding, stream bank erosion, and degradation of in-stream habitat. Storm water runoff could become contaminated as it flows across the surface and picks up pollutants from roadways, yards, farms, golf courses, and parking lots. Watershed land cover distribution is an important factor in the delivery of nonpoint source pollutants, such as sediment, nutrients, heavy metals, and pathogens, through soil erosion. As the amount of impervious surface area increases, the amount of storm water runoff increases.

The percentage of impervious surface area in a watershed is directly related to the hydrological, habitat, and water quality characteristics of the watershed (CWP, 2003). The threshold where indicators of stream quality shift toward degraded water quality is around 25 to 30 percent impervious cover (CWP, 2003).

As indicated above and shown in Figure 4.7-2 and Table 4.7-1, there are seven watersheds and 59 subwatersheds on Fort Belvoir (including EPG). The Accotink Bay, Gunston Cove, and Potomac River watersheds have the highest percentage of impervious surfaces, at 19, 16, and 14 percent, respectively. The Dogue Creek and Accotink Creek watersheds are 11 and 10 percent impervious, respectively; however, these watersheds contain the largest overall amount of impervious surface area because they are the two largest watersheds on the installation.

The Pohick Creek and Pohick Bay watersheds are less than one percent impervious (Horne, 2001). Unlike the Pohick Creek watershed, the Pohick Bay watershed originates on and is entirely contained within Fort Belvoir (Horne, 2001). With only 0.01 percent of its area being impervious, and 93.46 percent covered by forest lands (Horne, 2001), the Pohick Bay watershed is considered an intact watershed, as shown on Figure 4.7-1 (Fort Belvoir, 2004).

At the subwatershed level, seven subwatersheds exceed the 25 percent impervious threshold: subwatersheds 4, 29, 34, 39, 40, 41, and 43. Subwatershed 4 is in the Accotink Bay watershed

and west of the South Post Town Center. Subwatershed 29 is in the Accotink Creek watershed and in the center of the installation east of Accotink Village. Subwatershed 34 overlaps Woodlawn Village in the Dogue Creek watershed. The remaining four subwatersheds are on the North Post west of the DLA facility and north of Davison Army Airfield within the Accotink Creek watershed.

A quantitative determination of the relative impact of various construction options on water resources within Fort Belvoir requires the development of a baseline. The watersheds identified in the 1999 baseline watershed survey and revised with information from the 2003 update represents baseline conditions (Landgraf, 1999; 2003).

4.7.1.3.3 Storm Water Management

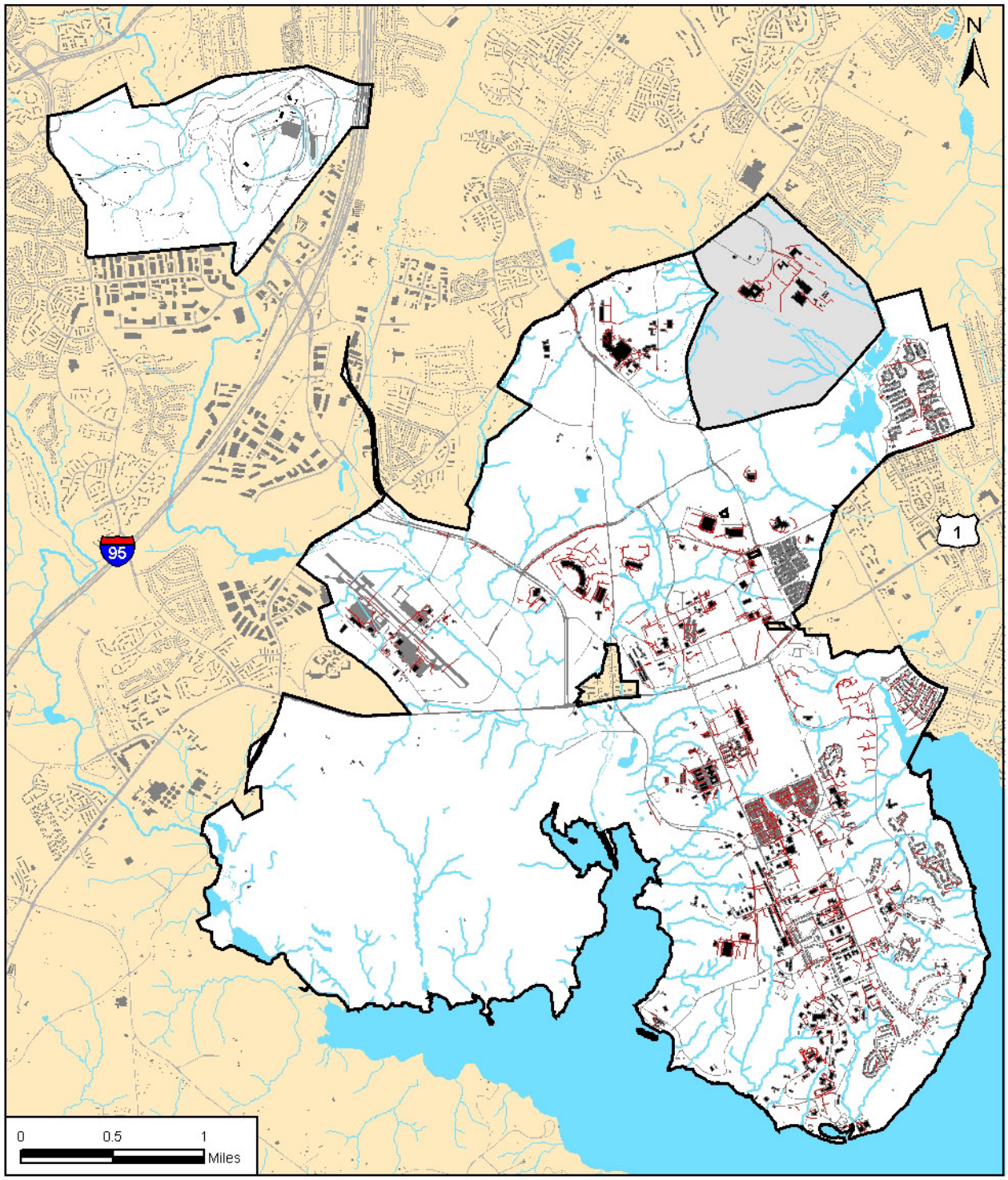
Developed areas on Fort Belvoir, including parking lots and roadways, are generally served by storm water drainage systems. EPG has historically been used as a training area and is currently little used. Storm water drainage on EPG is managed by a limited system of drainage ditches and culverts or conduits. For developed areas on the Main Post, the terrain has generally been modified to move storm water runoff away from facilities. Storm water draining off Fort Belvoir enters a storm water system consisting of approximately 22.4 miles of paved drainage ditches and 59.8 miles of storm drain pipes that ultimately discharge into various surface waterbodies. Additional storm water management structures on Fort Belvoir include storm water detention ponds and oil/water separators (Fort Belvoir, 2005b; Horne, 2001). Existing storm water management facilities include a DLA water feature, a rock catchment on the North Post, a Residential Communities Initiative (RCI) storm water management pond on the South Post, and various hydrodynamic devices, underground storage/detention pipes, storm water filter systems, and bioretention filters. Conventional infiltration practices are mostly used to control storm water from RCI housing areas. Figure 4.7-4 shows the location of storm water drainage pipes on Fort Belvoir. The pipes tend to be clustered around the developed portions of the installation. Section 4.7.2.4 presents information about storm water management practices at Fort Belvoir.

Generally, Fort Belvoir has had inadequate existing storm water management facilities because much of the development on the installation predated any storm water management regulations. Problem areas exist where unmanaged storm water threatens the viability of roads and utility lines, presents safety hazards, causes stream bank erosion, and renders sites undevelopable because of erosion and soil slumping. Refer to Section 4.12 for information on Fort Belvoir utilities and existing deficiencies.

The *Watershed Delineation Project Update* (Landgraf, 2003) identifies issues of concern with respect to sedimentation on Fort Belvoir: sedimentation from construction projects, inadequate installation and maintenance of erosion and sediment control measures, and lack of enforcement of minimum standards for erosion and sediment control. According to Landgraf (2003), Fort Belvoir has taken steps to improve these conditions, including the identification of 14 sites with erosion problems that had been remediated since the prior project survey in 1999.

Other storm water and flooding problems on the installation were recently noted by Fort Belvoir ENRD personnel, as follows (Master Plan/Drainage Study meeting on 11/16/06):

- Erosion and gullying occurs downstream of storm sewer outfalls. Erosion has also exposed utility lines at channel crossings.



LEGEND

Installation Property

Stormwater Line

Stormwater Lines

Fort Belvoir, Virginia

Sources: Fort Belvoir GIS, 2006; Fairfax County GIS, 2006.

Figure 4.7-4

- Every subwatershed on South Post has deeply incised stream channels. Channel erosion is also a problem on North Post and EPG but not as severe. Deeply incised channels are a sign of extreme flow conditions, instable stream banks and abnormal channel evolution.
- Problems exist with the intersection of larger storm water pipes into smaller ones.
- Flooding problems exist because of very flat drainage at the intersection of Gunston Road and 21st Street.
- Storm water management is limited on South Post. Several facilities are on North Post.
- Storm water management facilities were not designed to provide water quality control.
- Historical storm water mitigation strategies, such as dumping of concrete debris to remediate problem erosion sites in streams, were not effective. Also, the existing storm water system was not designed to handle storm flows from large areas of impervious surfaces.

Fort Belvoir is incorporating storm water management and protection methods into land planning and new development as well as correcting and retrofitting existing problem areas. A storm water drainage system master plan study is currently underway, as discussed above. This study will identify current deficiencies (e.g. capacity problems, outfall problems, stream bank erosion) and determine infrastructure needs required to meet BRAC requirements and long-term growth through 2030. This study will also provide recommendations for storm water quality and quantity control, such as required design criteria, potential locations for new facilities, and methodologies that should be used or avoided.

The MS4 storm water management program discussed in Section 4.7.1.3.1 requires "minimum control measures," including Best Management Practices (BMPs) to control storm water and pollutants in runoff. Fort Belvoir is developing pollution control measures that must be implemented within 5 years of permit issuance. The following management recommendations from the Fort Belvoir INRMP (Horne, 2001), Landgraf (2003), and the *Watershed-based Stream Corridor Management and Protection, Fort Belvoir, VA* report by Allen et al. (1999) are being considered for incorporation into the Phase II Storm Water Regulations as part of the INRMP planning process:

- Maintain a riparian buffer along all installation waterways and shorelines.
- Correct existing storm water-related problems as recommended by Landgraf (2003) and continue long-term stream corridor restoration projects.
- Implement actions to counter existing flow excesses from developed areas as recommended by Allen et al. (1999).
- Develop a program for routine drainageway maintenance, to include maintenance of existing storm water structures, and establish a storm water management working group.
- Implement storm water management actions, including BMPs, on all construction projects.
- Continue to incorporate principles of LID in facility siting and design on-post as recommended in *Low-Impact Development Design Strategies* (Prince George's County Department of Environmental Resources, 1999).

Numerous practices have been implemented on Fort Belvoir to control storm water runoff. These efforts include the construction of permanent storm water management ponds; reduction in the use of fertilizers to reduce nutrient runoff to receiving waters; revegetation of exposed slopes, creeks and stream banks; percolation trenches adjacent to parking lots; and using temporary sedimentation basins at construction sites. More recent efforts include implementing the *rain garden* concept of storm water management, which maximizes groundwater penetration as

opposed to runoff. Rain gardens are landscape design features consisting of localized topographic depressions planted with naturally hardy plants, usually a combination of trees, shrubs, hardy perennials, or grasses, and strategically located next to hard surfaces from which storm water runoff and snowmelt can be diverted and can collect. Rain gardens serve as retention areas that promote infiltration and reduce runoff. Examples are in place at the AMC temporary buildings and at the Davison Army Airfield Fire Station (Fort Belvoir, 2005b).

4.7.1.4 Groundwater

Fort Belvoir is underlain by three subsurface aquifers: Lower Potomac, Middle Potomac, and Bacons Castle Formation. These three aquifers are within the Potomac Group, a sequence of unconsolidated sediments characteristic of the Coastal Plain and underlying Fort Belvoir. The Lower Potomac aquifer, the primary aquifer in eastern Fairfax County, contains potable water below Fort Belvoir. The aquifer lies between a layer of crystalline bedrock and a clay wedge containing sandy clays and interbedded layers of sand. The aquifer is recharged by surface infiltration north and west of Fort Belvoir and flows to the southeast.

The Middle Potomac aquifer consists of interbedded lenses of differing thicknesses of sand, silt, and clay, but its confining unit is not present in the vicinity of Fort Belvoir. The Bacons Castle Formation is the shallowest aquifer of the three and is recharged by and discharges to waterbodies on the installation (Horne, 2001; Fort Belvoir DPW ENRD, 2002).

The water table on Fort Belvoir lies approximately 10 to 35 feet below the ground surface (except within and directly adjoining wetland and floodplain areas). Some areas on the installation have perched water tables approximately 2 feet below the surface as a result of groundwater trapped in strata overlying impermeable clays (Fort Belvoir DPW ENRD, 2002; Fort Belvoir, 2005b). Groundwater flow patterns for the unconfined uppermost saturated layer (water table aquifer) on EPG generally follow surface water drainage. However, local groundwater flow patterns could be affected by the heterogeneous nature of the unconsolidated fluvial deltaic Coastal Plain sediments. Groundwater could become perched in lenses within the unconsolidated sediments, as referenced above. The density and orientation of fracture and fault systems existing within the rock formations generally control groundwater flow within the crystalline rocks or saprolite of the Piedmont. The orientation of these systems is highly variable on a local scale.

Fort Belvoir does not have any active potable groundwater wells on the Main Post or EPG but rather obtains all its potable water supply from the Fairfax County Water Authority in the amount of 2.2 mgd. A well inventory counted 220 groundwater supply and monitoring wells on Fort Belvoir, the majority of which are monitoring wells or inactive. Four wells are used for irrigation for the golf courses, and one supplies the MDW horse stables. Between 2001 and 2004, an average of 12.9 million gallons per year was drawn from the golf course wells for irrigation (Russell, 2005; Horne, 2001).

4.7.1.5 Other Water Resources Policies

In general, Fort Belvoir must comply with all applicable DoD, Army, Fort Belvoir, federal, and state statutes and regulations concerning water resources. The Fort Belvoir INRMP (Horne, 2001) provides a comprehensive list of relevant regulations and policies. Applicable regulations including the CZMA, Chesapeake Bay agreements, and floodplain management are described below. In addition, Fairfax County is developing watershed management plans for each of the County's watersheds. These plans include information on watershed characterization, storm

water management, baseline and future watershed modeling scenarios, recommended BMPs, and recommended policies and other initiatives to improve watershed conditions.

4.7.1.5.1 Coastal Zone Management Act (CZMA) and Chesapeake Bay Initiatives

The CZMA's goal is to preserve, protect, develop, and where possible, restore or enhance the resources of the coastal zone of the United States. The CZMA as it applies to Fort Belvoir contains a federal consistency requirement, by which federal actions must be consistent to the maximum extent practicable with the enforceable policies of the federally approved Virginia Coastal Resources Management Program (VCRMP). This program focuses on problems associated with polluted runoff, habitat protection, riparian buffers, Resource Protection Areas (RPAs), wetlands, fisheries, sustainable development, waterfront redevelopment and encroachment, septic systems, erosion and sediment control, and air pollution control (VDEQ Coastal Program Office, 2004). Virginia's coastal zone includes all of Fairfax County, which encompasses Fort Belvoir and the 12.25 miles of Potomac River shoreline on the installation (VDEQ Coastal Program Office, 2003). Under the CZMA and VCRMP, the Commonwealth of Virginia will be notified and then has six months from notification, to concur with or object to the Consistency Determination under CZMA. A federal consistency determination letter will be submitted in accordance with CZMA and VCRMP requirements.

Waterbodies on Fort Belvoir drain to the Potomac River and ultimately into the Chesapeake Bay. The Potomac River watershed covers approximately 14,670 square miles of diverse land uses in four states (Virginia, West Virginia, Maryland, and Pennsylvania) and the District of Columbia. The Potomac River extends more than 380 miles and reaches a width of more than 11 miles where it meets the Chesapeake Bay at Point Lookout, Maryland. The Potomac River was designated an American Heritage River in 1998 (EPA, 2004).

The Chesapeake Bay is the nation's largest estuary. It supplies vast amounts of seafood, is a major hub for shipping and commerce, provides natural habitat for a wide range of wildlife, and offers a variety of recreational opportunities for residents and visitors. The Chesapeake Bay watershed is a 64,000-square-mile drainage basin covering parts of New York, Pennsylvania, West Virginia, Delaware, Maryland and Virginia, as well as the entire District of Columbia (Chesapeake Bay Program, 2000).

Management of Fort Belvoir waterbodies is guided by several Chesapeake Bay agreements. These include the 1987 Chesapeake Bay Agreement, the Cooperative Agreement between DoD and EPA Concerning Chesapeake Bay Activities, the Agreement of Federal Agencies on Ecosystem Management in the Chesapeake Bay, Federal Agencies Chesapeake Ecosystem Unified Plan (FACEUP), and Chesapeake 2000. These agreements address water quality and aim to protect and restore the Chesapeake Bay's aquatic resources. They accomplish this by consolidating existing regulatory requirements, such as water quality protection under the CWA, and supplementing these regulations with policy and guidance addressing unregulated, but ecologically significant management considerations, such as the establishment of adequate vegetated cover, the protection of wetlands, and storm water runoff control (Horne, 2001). In addition, since Fort Belvoir is considered to be a Chesapeake Bay Preservation area, the new Phase II VPDES program expands permit coverage to storm water discharges from construction activities affecting more than 2,500 square feet (VDCR, 2005).

State and local efforts for protection of the Chesapeake Bay also guide management of Fort Belvoir waterbodies. In response to the 1987 Chesapeake Bay Agreement, the Virginia

Chesapeake Bay Preservation Act (CBPA) was enacted to protect the Chesapeake Bay from further degradation from nonpoint source pollution and sedimentation. Under the CBPA, Fairfax County adopted a Chesapeake Bay Preservation Ordinance that designates RPAs and Resource Management Areas (RMAs).

RPAs are regulatory zones along streams protected from most forms of development to preserve their function as biological filters and buffers. RPAs generally include major floodplains, riparian areas, and vegetated lands within 100 feet of tidal and nontidal wetlands, tidal shores, and perennial streams. Fort Belvoir has about 1,984 acres of RPAs, covering about 23 percent of the installation (Fort Belvoir GIS, 2006). RPAs on Fort Belvoir are shown in Figure 4.7-1. RPAs help filter storm water runoff and prevent nutrients, toxic substances, and sediments from entering streams, rivers, and, ultimately, the Chesapeake Bay. They also provide valuable wildlife habitat (Horne, 2001). All land outside of an RPA in Fairfax County is classified as an RMA.

Riparian areas should be given special consideration when planning development (Directive No. 94-1 in the Chesapeake Bay Agreements, Riparian Forest Buffers). A riparian area is generally an area of land adjacent to a body of water, stream, river, marsh, or shoreline that provides a transition zone between the aquatic and terrestrial environment. The riparian areas shown on Figure 4.7-1 represent areas within 35 feet of an intermittent or perennial stream, alluvial soils, and soils with slopes greater than 15 percent (Fort Belvoir GIS, 2006). Riparian areas are generally vegetated and act as a buffer to reduce effects of upland sources of pollution by trapping or filtering sediments, nutrients, and other chemicals and preventing them from entering a waterbody. Benefits from vegetated riparian areas include water quality enhancement, storm water and floodwater management, stream bank and shoreline stabilization, water temperature modification, wildlife habitat protection, pollutant absorption, and a high overall aesthetic appearance. New development must be minimized in riparian areas and continuous riparian corridors maintained, particularly in ravines and along the shoreline. Section 4.8 provides additional information on flora and fauna typically found within riparian areas on Fort Belvoir.

4.7.1.5.2 Floodplain Management

Under Executive Order (EO) 11988, Floodplain Management (May 24, 1977), Fort Belvoir is required to evaluate any potential effects of any action occurring in a floodplain (Horne, 2001). Approximately 1,593 acres, or 19 percent of the installation, are within a 100-year floodplain of a waterway (Fort Belvoir GIS, 2006; FEMA, 1990). Notable floodplains occur along Pohick, Accotink, and Dogue Creeks and their larger tributaries, and along the Potomac River on the installation.

4.7.2 ENVIRONMENTAL CONSEQUENCES OF THE PREFERRED ALTERNATIVE

Environmental effects on water resources as a result of the proposed action primarily relate to the potential for increases in storm water runoff and associated pollutants from land disturbance activities, construction-associated effects, conversion of pervious areas to impervious, potential loss of riparian buffers, and other physical changes to watershed features. Storm water runoff increases flow volumes, velocity, peak flows, and the delivery of sediment and other pollutants to streams. The potential for erosion in an area is characterized by the interaction of four primary factors: the characteristics of its soils, its vegetative cover, its topography, and its climate. All these factors also determine the magnitude of storm water runoff. In general, storm water runoff potential increases with decreasing soil moisture retention and vegetative cover and increasing impervious land area, land slope, and precipitation volume. Similarly, erosion potential increases

with decreasing soil consolidation and vegetative cover and increasing land slope, precipitation volume and storm water runoff.

To determine the potential environmental consequences on water resources as a result of the proposed action, an assessment of current, or baseline, conditions was made. This required a detailed examination of the existing distribution of land use areas and soil types and characterization of surface elevations, subwatersheds, and stream networks on the installation. Baseline peak flow conditions and potential effects of the proposed development scenarios within each subwatershed were modeled using the Technical Release 55 (TR-55) small watershed runoff model (NRCS, 1986). Potential changes in pollutant loads were estimated for each subwatershed using the Generalized Watershed Loading Functions (GWLF) model. Watershed modeling was also used to assess potential cumulative effects on flow and pollutant loads due to anticipated future development in the watersheds that drain Fort Belvoir. The process of evaluating the different development scenarios required the modification of land uses to account for the location of proposed facilities and associated development areas. The increase in impervious surfaces and their locations as a result of the proposed land use development scenarios were the variable factors used to assess potential effects on water resources. Note that these analyses were performed based on the preliminary siting of proposed BRAC facilities and other future development projects within the watersheds that drain Fort Belvoir; therefore, potential reductions in storm water runoff and associated pollutants due to BMP implementation and mitigation efforts were not considered. The types of BMPs that will be implemented and other storm water control activities will depend on final site/parcel development plans. Proper storm water planning and implementation of effective storm water management practices, as required by regulation and through proposed mitigation efforts, will reduce the estimated runoff and pollutant loads presented under each of the alternatives discussed below. Additional information on model development, technical assumptions, and analysis is presented in Appendix F.

4.7.2.1 Surface Water Quality

4.7.2.1.1 Land Use Plan Update

Short- and long-term minor adverse effects to surface water quality, ground water quality, and water resources protection would be expected at the watershed scale; however, localized effects could be more pronounced. Construction of facilities and infrastructure as a result of changes in land use designations could result in increased runoff due to an overall increase in impervious surface area, increased erosion, and increased sediment and pollutant loads. A reduction in pervious area may reduce infiltration and groundwater levels which can cause increases in pollutant concentrations in surface runoff. Decreased infiltration can also lead to lower stream baseflow conditions during dry periods. RPAs and riparian buffers also extend into areas proposed for land use designation changes. Encroachment into these areas decreases the buffer between developed land and sensitive natural resources. In addition, proposed infrastructure projects include a new bridge crossing over Accotink Creek and the replacement of existing bridges over Accotink Creek and Dogue Creek. Bridge construction and repairs will require the issuance of a Corps of Engineers Section 404 permit and a VWP permit by VDEQ.

Table 4.7-6 presents the land use changes that could have an impact on water resources (i.e., land use change from undeveloped to developed). Section 4.7.2.1.2 provides a detailed analysis of the potential effects to surface water quality from short- and long-range development projects.

Table 4.7-6
Potential land use plan effects to water resources under the Preferred Alternative

Proposed change	Water resources present in area	Potential effects
Develop Administrative Center on EPG for NGA and WHS; convert land use designation from Training to Professional/ Institutional	RPAs and riparian areas extend into EPG east and the proposed Remote Delivery Facility on EPG west along tributaries of Accotink Creek and the creek along the eastern boundary of EPG.	Encroachment of development near RPAs and riparian areas. Increased area of impervious surfaces would increase runoff, erosion, and pollutant and sediment loads. Reduction in pervious surfaces would reduce ground absorption of runoff, thereby reducing flow to existing groundwater seeps, where present
Convert South Post golf course (Recreation land use) on South Post into Community land use for new hospital	Apart from storm water drainage features, RPAs, riparian areas and wetlands.	Encroachment of development near RPAs, riparian areas and wetlands. Increased area of impervious surfaces could increase runoff, erosion, and pollutant and sediment loads, and could reduce ground absorption of runoff, thereby reducing flow to existing groundwater seeps, where present. Increased sediment could affect the new storm water system and filters for the new on-post development.
South Post eastern and southern areas–convert Environmentally Sensitive and Outdoor Recreation land uses to Professional/Institutional, Community, Training, and Residential	On the South Post plateau, apart from storm water drainage features, no notable water resources present	Increased area of impervious surfaces could increase runoff, erosion, and pollutant and sediment loads, and could reduce ground absorption of runoff, thereby reducing flow to existing groundwater seeps, where present.
North Post–convert Environmentally Sensitive and Outdoor Recreation land uses to Professional/Institutional, Community, Training, and Residential	RPAs, riparian areas, and flood zones along Mason Run and tributaries	Encroachment of development near RPAs and riparian areas; no development would occur within these areas. Increased area of impervious surfaces could increase runoff, erosion, and pollutant and sediment loads, and could reduce ground absorption of runoff, thereby reducing flow to existing groundwater seeps, where present.

4.7.2.1.2 BRAC Implementation and Facilities Projects

Storm water

Short- and long-term minor adverse effects would be expected at the watershed scale; however, localized effects could be more pronounced. To comply with federal, state, and installation requirements, Fort Belvoir would minimize potential effects through effective storm water planning, the development of adequate infrastructure, and the use of BMPs. Storm water requirements are addressed under the VPDES program, which includes the development of comprehensive SWPPPs that describe the BMPs to be used to minimize runoff and soil erosion from each construction site and Virginia's Erosion and Sediment Control Regulations. Fort Belvoir's storm water permits (general permits and MS4) regulate storm water discharges on the installation. The state reviews and oversees implementation of the required storm water practices.

Note that in the absence of state-required storm water management practices and erosion control measures being implemented on a watershed basis, short- and long-term effects would be much greater in severity.

Approximately 86 acres of high-intensity and 262 acres of medium-intensity development would be added to the installation by implementing the Preferred Alternative. High-intensity development includes areas where people work or reside in high numbers (e.g. apartment complexes and commercial/industrial areas). Medium-intensity includes a mixture of developed and nondeveloped land with impervious cover occupying 50-80 percent of the total land area. Impervious surfaces would substantially increase in Subwatersheds 1 (119 percent), 3 (32 percent), 25 (75 percent), 53 (910 percent), 54 (352 percent), 55 (325 percent), 57 (285 percent), 58 (194 percent), and 59 (134 percent). Increased impervious surface associated with development typically causes an increase in volume, velocity, and peak flow rates of runoff to nearby streams. Stream channels naturally attempt to accommodate the increased flows by increasing their cross-sectional area. This occurs through erosion of stream banks or down-cutting of the channel beds.

Virginia's Storm Water Management (SWM) Regulations specify evaluating storm water runoff using 2-year or 1-year storm event data in order to assess potential erosion problems and channel adequacy. These regulations also include the requirement for an adequate outfall analysis or use of 1-year, 24-hour extended detention to protect receiving waters. Increased volume might translate to flooding where the stream channel is not adequate to contain the flow. During the 10-year, 24-hour storm event, an increase in volume increases the potential for bank overtopping and flooding. Virginia's Erosion and Sediment Control Regulations (4VAC50-30-40.19) and SWM Regulations (4VAC3-20-81) require that, "downstream channels and properties be protected from erosion and damage due to increases in volume, velocity and peak flow rate." Because of this, site-specific BMPs or mitigation measures would be required for each construction site. A watershed-based approach would be implemented to evaluate upstream and downstream concerns and mitigate possible effects. As discussed above, BMPs and potential mitigation efforts were not included in the following analyses. The types of BMPs that will be implemented and other storm water control activities will depend on final site/parcel development plans.

The 1-year and the 10-year, 24-hour storm events were modeled using the Technical Release 55 (TR-55) model, developed by the NRCS (1986), to evaluate potential changes in peak flows as a result of the proposed action in each subwatershed. These storm events are identified in Virginia's Erosion and Sediment Control Regulations. These regulations require that properties and waterways be protected from damages from flooding due to increases in volume, velocity, and peak flow rates. The 10-year, post-development peak discharge flow rate is not to exceed the 10-year, pre-development peak rate (4VAC50-30-40.19). The threshold used to determine potential adverse effects for this analysis was a 10 percent increase in peak flow occurring from a 1-year, 24-hour and a 10-year, 24-hour storm event. Subwatersheds 1, 3, 25, 53, 54, 55, 57, 58, and 59 would all be expected to have greater than a 10 percent increase in peak flow during the 1-year storm event under the Preferred Alternative, with Subwatershed 1 experiencing the highest percent increase (100 percent). Table 4.7-7 lists the percent increase in peak flow from a 1-year, 24-hour storm event for each subwatershed and the proposed construction projects that would affect runoff. Each of these subwatersheds, except for Subwatershed 3 would also experience at least a 10 percent increase in peak discharge during a 10-year, 24-hour storm event, indicating there would be a moderate to high increase in flood levels (Table 4.7-7). Table F-1 in Appendix F lists the peak flow percent increase for each subwatershed if the Preferred Alternative projects were implemented.

Table 4.7-7
Subwatersheds with greater than 10 percent increase in 1-year or 10-year storm event peak discharge under the Preferred Alternative

Subwatershed number	Percent increase in 1-year storm event peak discharge	Percent increase in 10-year storm event peak discharge	Affecting projects
1	100%	63%	Hospital, Dental Clinic, AMC Relocatables, Infrastructure
3	12%	< 10%	Hospital, Dental Clinic, AMC Relocatables, Infrastructure
25	36%	16%	Hospital, Dental Clinic, NARMC HQ Building
53	77%	22%	NGA, Infrastructure
54	29%	10%	Infrastructure
55	56%	17%	Infrastructure
57	93%	33%	NGA, Infrastructure, Child Development Center (CDC) (NGA), Corps Integration Office
58	70%	31%	NGA, WHS, Infrastructure, Emergency Services Center (EPG) , Corps Integration Office
59	82%	34%	NGA, WHS, Infrastructure, Emergency Services Center (EPG)

Sediment

Short- and long-term minor adverse effects would be expected at the watershed scale; however, localized effects could be more pronounced. To comply with federal, state, and installation requirements, Fort Belvoir would minimize potential erosion and sedimentation effects through storm water planning, development of adequate infrastructure, and the use of BMPs. During the initial development phase, proper erosion and sediment controls would be used to manage construction activities that could result in an increase in the sedimentation in adjacent waterbodies. A VPDES permit would be required for construction projects disturbing at least 2,500 square feet. A soil erosion and sediment control plan and SWPPP would be required to provide guidance for reducing sedimentation effects during the construction process. In the long-term, an increase in storm water volume from impervious surfaces could result in an increase in erosion and sedimentation. Proper storm water controls, as discussed above, would be implemented as part of the development to minimize the potential effects of increased sediment loads during wet-weather events.

Fort Belvoir was surveyed to characterize watershed conditions and identify erosion problem site locations in 1999, and monitoring of these sites has occurred since (Landgraf, 2003). Table 4.7-8 lists the Preferred Alternative projects that are within close proximity (150 feet) of the previously identified erosion and other problem sites in each watershed. Construction activities and impervious surfaces could increase sediment and storm water runoff into waterbodies, thereby exacerbating erosion and other stream effects at these sites. Ten Preferred Alternative projects have existing erosion sites and other stream effects within 150 feet of their footprint. These projects could affect one or more existing problem areas due to an increase in impervious surfaces and resulting storm water from each site. Other projects have few or no erosion/problem

Table 4.7-8
Projects located within proximity of erosion and other problem sites under the Preferred Alternative

Map number (see Table 2-3)	Project description	Watershed number	Nearby watersheds	Erosion and other problems noted within 150 feet
1	NGA	53, 59	Accotink Creek	1 blocked pipe, 3 corroded or corrupt pipe, 1 gully, 1 scour hole, 3 undercut structure low
2	WHS	58, 59	Field Lark Branch, trib. to Accotink Creek	1 bank erosion medium, 2 blocked pipe, 2 corroded or corrupt pipe, 10 down-cutting low, 3 down-cutting medium, 1 down-cutting severe, 2 scour hole, 1 sediment deposition, 1 undercut structure low, 2 undercut structure medium, 1 undercut structure severe
8	Infrastructure	53, 54, 55, 57, 58, 59	Accotink Creek, Field Lark Branch, trib. to Accotink Creek	3 bank erosion low, 11 bank erosion medium, 4 bank erosion severe, 5 blocked pipe, 7 corroded or corrupt pipe, 11 down-cutting low, 3 down-cutting medium, 2 down-cutting severe, 2 gully, 9 scour hole, 3 sediment deposition, 2 undercut structure medium, 1 undercut structure severe
8	Gunston Road Improvements (Infrastructure)	1, 3, 29, 30	Trib. to Accotink Creek, Mason Run	2 bank erosion severe, 4 blocked pipe, 1 corrected sites, 4 down-cutting low, 4 down-cutting medium, 2 down-cutting severe, 3 scour hole, 1 sediment deposition, 1 undercut structure low, 3 undercut structure medium, 2 undercut structure severe
9	Emergency Services Center (EPG)	58, 59	Field Lark Branch, trib. to Accotink Creek	1 bank erosion medium, 2 blocked pipe, 2 corroded or corrupt pipe, 6 down-cutting low, 2 down-cutting medium, 1 down-cutting severe, 1 scour hole, 1 sediment deposition, 1 undercut structure low, 1 undercut structure medium, 1 undercut structure severe
10	Network Ops Center	14	Trib. to Accotink Creek, Accotink Creek	1 blocked pipe, 2 down-cutting low, 1 down-cutting medium, 1 scour hole
12	Child Development Center (NGA)	53, 59	Accotink Creek, trib. to Accotink Creek	1 blocked pipe, 3 corroded or corrupt pipe, 1 gully, 1 undercut structure low
13	Child Development Center	58, 59	Field Lark Branch, trib. to Accotink Creek	1 bank erosion medium, 2 blocked pipe, 2 corroded or corrupt pipe, 6 down-cutting low, 2 down-cutting medium, 1 down-cutting severe, 1 scour hole, 1 sediment deposition, 1 undercut structure low, 1 undercut structure medium, 1 undercut structure severe
16	AMC Relocatables	1	Trib. to Accotink Creek, trib. to Dogue Creek	2 blocked pipe, 1 corroded or corrupt pipe, 1 down-cutting low, 1 down-cutting medium, 2 scour hole, 2 undercut structure low
17	PEO EIS Admin. Facility	22	Trib. to Dogue Creek, trib. to Accotink Creek	1 undercut structure low, 1 bank erosion medium, 1 down-cutting severe

sites in the vicinity and would have minimal or no effect on stream bank erosion and other characteristics.

Other Pollutants

Short- and long-term minor adverse effects would be expected at the watershed scale; however, localized effects could be more pronounced. During the initial development phase, construction activities could result in an increase in sediment loading, dissolved solids, petroleum hydrocarbons, and other pollutants in adjacent waterbodies. Measurable effects would be expected to be minimal because the installation would comply with federal, state, and installation regulations, and necessary permits for storm water control would be obtained. Site-specific SWPPPs describing the BMPs to be used to minimize effects from increased runoff during site construction would be prepared.

In the long-term, an increase in storm water volume from additional impervious surfaces could result in an increase in nutrients, metals, and other potential contaminants in waterbodies. Proper storm water controls, as discussed above, would be implemented as part of the development to minimize the potential effects of pollutant loading during wet-weather events. Implementation of low impact development (LID) techniques would also be used, where possible, to manage the hydrology and quality of storm water runoff from impervious surfaces to reduce this adverse effect. Examples of LID techniques include decreasing the connectivity and amount of impervious cover, limiting land clearing, and capturing runoff.

Nutrients, such as total nitrogen and total phosphorus, are parameters of concern according to the Chesapeake Bay agreement. Total nitrogen loading from land to streams is influenced by the use of fertilizers, presence of animal waste, and faulty septic systems, as well as by natural sources. Urban, agricultural, and barren land uses are the primary contributors. Nitrogen contributes to low dissolved oxygen levels through bacterial activity and could be toxic to aquatic life. Total phosphorus loading from land to streams is influenced by the use of fertilizers and the presence of animal waste, as well as by natural sources. Urban and agricultural land uses are the primary contributors. Phosphorus is typically the limiting nutrient in freshwater systems and could accelerate waterbody eutrophication.

Potential increases in nutrient loads in Fort Belvoir subwatersheds as a result of the Preferred Alternative were calculated using land use-specific loading coefficients. Loading coefficients were developed based on the watershed modeling results for Accotink Creek using the GWLF model (Haith and Shoemaker, 1987; Haith, Mandel, and Wu, 1992; Dai et al., 2000). GWLF was used to compute the nutrient loads contributed by various land uses in each of the subwatersheds that drain Fort Belvoir. A detailed description of the GWLF model and its capabilities is presented in Appendix F.

Using the land use distributions and applying the associated loading ratios, the average annual percent change in total nitrogen (TN) and total phosphorus (TP) loading was calculated for each subwatershed. Subwatersheds with greater than a 10-percent change in nitrogen and phosphorus loads as a result of the proposed action are shown in Table 4.7-9. Proposed construction projects in each subwatershed that would affect nitrogen and phosphorus loading are also shown in this table. Table F-2 in Appendix F shows the percent change for each subwatershed.

Table 4.7-9
Subwatersheds with greater than 10-percent increase in TN and TP loads under the Preferred Alternative

Subwatershed number	Percent increase in TP	Percent increase in TN	Affecting projects
53	51%	68%	NGA, Infrastructure
54	8%	17%	Infrastructure
55	26%	39%	Infrastructure
57	19%	31%	NGA, Infrastructure, CDC (NGA)
58	22%	33%	NGA, WHS, Infrastructure, Emergency Services Center (EPG)

4.7.2.2 Groundwater Quality

4.7.2.2.1 Land Use Plan Update

Short- and long-term effects on groundwater quality are presented in Section 4.7.2.1.1

4.7.2.2.2 BRAC Implementation and Facilities Projects

Long-term indirect minor adverse effects would be expected at the watershed scale; however, localized effects could be more pronounced. Approximately 183 acres, or about two percent of the installation, would be converted to impervious surfaces under the Preferred Alternative. Much of this acreage is on an upland plateau, which follows the I-95 corridor and serves as a groundwater recharge area. The reduction in pervious surfaces would reduce the absorption of runoff into the ground, and therefore reduce flow to existing groundwater seeps, such as the rare coastal plain/piedmont acidic seepage swamp communities scattered around the installation (Fort Belvoir DPW ENRD, 2002). Seepage swamp communities could be affected by projects within close proximity, depending on ground water flow patterns. The Gunston Road Improvements site (part of Infrastructure, Project #8) is the only project located within 200 feet of a seepage swamp community. In addition, infiltration of increased storm water runoff into the groundwater in other areas could increase nitrogen loads and other contaminants such as soluble metals. Absorption loss and infiltration of pollutants could partially be alleviated by installing BMPs that facilitate infiltration to groundwater, such as bioretention facilities planted with native, wet-tolerant plants (Davis, 2004; Fort Belvoir July 2003). By increasing infiltration, plant uptake and soil processes will filter and decrease pollutant loads. Groundwater withdrawal for potable water supply would not be adversely affected by the proposed action because, although an aquifer containing potentially potable groundwater is present below Fort Belvoir, it is not used for drinking water supply. In addition, the proposed action would not include installation or removal of any septic tanks.

4.7.2.3 Water Resources Protection

4.7.2.3.1 Land Use Plan Update

Short- and long-term effects on water resources protection are presented in Section 4.7.2.1.1

4.7.2.3.2 BRAC Implementation and Facilities Projects

Chesapeake Bay

Short- and long-term minor adverse effects could be expected at the watershed scale; however, localized effects could be more pronounced. In the short-term, vegetation in the RPAs could be damaged or destroyed by construction activities in and near the RPAs. There is also potential for increased storm water flow and increased scouring in the RPAs along tributaries due to increased sedimentation from construction site runoff, and in the long-term, increased impervious surfaces. Pursuant to the Fairfax County Chesapeake Bay Preservation Ordinance amendments of 2003, storm water runoff must be controlled through the effective use of BMPs to avoid or minimize erosion and control sediment, nutrients, and other pesticides.

In the long-term, approximately 14 acres of RPAs would be affected by seven projects under the Preferred Alternative (Table 4.7-10). The impact acreages were based on project footprint data provided by BRAC personnel. Prior to construction, project locations will be adjusted based on consultation between Army and federal/state regulators to avoid, minimize, and mitigate potential impacts to wetlands and RPAs to the maximum extent practicable. The following projects encroach into designated RPA areas: WHS (Project #2), Emergency Services Center (EPG) (Project #9), CDC (EPG) (Project #13), Infrastructure (Project #8), and Gunston Road Improvements (Project #8). Roadways may be permitted to be constructed in RPAs, if SWPPPs are completed and all other permits obtained. Final siting of all other projects should avoid or minimize effects to RPAs. For those projects, a Water Quality Impact Assessment would be required for development in RPAs because they do not qualify for the roadway or utility right-of-way exclusion.

Table 4.7-10
Affected RPAs in the Preferred Alternative

Area (Acres)	Projects affecting RPAs
1.0	WHS, Emergency Svcs Center (EPG), Child Dev Center – 303 (EPG)
4.8	Infrastructure (Gunston Road Improvements)
7.9	Infrastructure
13.7	**Total**

Coastal Zone Management Act

Implementation of the Preferred Action would occur in a manner consistent with the CZMA and the Commonwealth of Virginia's CRMP. As discussed in Section 4.7.1.5.1, the CZMA requires identification of potential effects on storm water runoff, habitat protection, riparian buffers, RPAs, wetlands, fisheries, sustainable development, waterfront redevelopment and encroachment, septic systems, erosion and sediment control, and air pollution control. These resources, primarily storm water runoff, would be adversely affected by the proposed action. However, required mitigation for storm water management, wetland loss, and stream channel alteration as well as other efforts discussed in Section 4.7.2.4 (BMPs/Mitigation), would alleviate these concerns. Effects of the Preferred Alternative projects subject to federal consistency under the CZMA are described below.

Increases in storm water runoff would be expected due to an increase in imperviousness as described in Section 4.7.2.1.2. Temporary increases in sediment loads in construction-site runoff would be expected during construction of individual projects. A VPDES permit would be required for those projects disturbing at least 2,500 square feet, and a soil erosion and sediment control plan as well as a SWPPP would be required to provide guidance for implementing sediment-laden runoff minimization techniques during the construction process (VDEQ, 2004).

The proposed action would be expected to discharge wastewater into the Fort Belvoir sewer system, which is connected to the Fairfax County wastewater system and treated at the Noman M. Cole Jr. Pollution Control Plant (Fort Belvoir DPW ENRD, 2002). Discharge of wastewater to an existing treatment facility would be consistent with the CZMA. See Section 4.12 for information on Fort Belvoir utilities and existing deficiencies.

Wetlands could also be affected under the Preferred Alternative. Effects on wetlands are further discussed in Section 4.8 (Biological Resources). In addition, approximately 14 acres of Chesapeake Bay RPAs would be affected by several projects, as discussed under the previous section.

The CZMA requires that the following resources also be addressed: air quality, subaqueous lands, fisheries, primary sand dunes, and septic systems. As discussed in Section 4.4, effects to air quality are expected due to increases in transportation and other effects. In addition, no effects on subaqueous lands or fisheries resources would be expected as utility crossings would be expected to cross at bridges, and no primary sand dunes occur on Fort Belvoir. The proposed action would not include installation or removal of any septic tanks. The CZMA Consistency Determination is provided in Appendix C.

Floodplains

Long-term minor adverse effects would be expected at the watershed scale; however, localized effects could be more pronounced. Under current National Flood Insurance Program and Fairfax County zoning limitations, no permanent dwellings are permitted to be constructed within the 100-year floodplain boundary, although roadways, athletic fields, and similar facilities are generally permitted (USACE, 2003). One project under the Preferred Alternative would affect floodplains. Approximately 2.9 acres of floodplain would fall within the footprint of the Infrastructure (Project #8) project sites. Although roadways are generally permitted in floodplains, roadways and infrastructure projects that might encroach into floodplain areas would be realigned or reconfigured where possible. No other conflicts with floodplains were identified; however, each of the individual Preferred Alternative construction projects would be evaluated for floodplain intrusion on a project-by-project basis to avoid or mitigate potential conflicts.

4.7.2.4 BMPs/Mitigation

BMPs and proposed mitigation measures are recommended as generally applicable practices that can help limit short- and long-term impacts on water resources that may be caused by site development and related activities.

4.7.2.4.1 Surface Water Quality

BMPs

- Plan and construct BMPs in accordance with all applicable storm water, erosion control, and pollutant removal requirements. Ensure detention requirements are met for the 2- and

10-year, 24-hour design storms, and outfall protection according to the 1-year, 24-hour extended detention method (re: Virginia's SWM regulations, Virginia Erosion and Sediment Control Handbook, Fairfax County PFM, and other applicable regulations).

- During and following construction activities, continue to use construction-phase, enhanced erosion and sediment control BMPs beyond specifications and requirements, including staged development, prompt stabilization of exposed soil, silt fences, sediment traps, storm drain inlet filters, and sediment basins where practicable, to minimize erosion and sedimentation until the site has stabilized. Conduct regular maintenance of the construction phase erosion and sediment control BMPs as described in the erosion and sediment control plan for each project. For erosion prone areas, such as steep slopes, and runoff that could adversely affect highly sensitive environmental habitats, employ integrated BMPs to capture sediments that could enter streams, wetlands, and RPAs.
- For each new development project protect downstream water quality by treating the majority of the site with BMPs that are at least 40% efficient at removing phosphorus. Projects that qualify as redevelopment are also required to remove phosphorus by following methodologies identified in the Fairfax County PFM.
- Wetland and stream impacts that could result from the proposed projects will be addressed by federal and state permit programs under CWA section 404/401.
- Implement post-construction BMPs that exceed state and local requirements for the management of storm water runoff. These BMPs could include the following:
    - LID management practices that seek to reduce impervious cover and control storm water runoff as close to the source as feasible, such as the following:
        - Reduce impervious cover during the design phase to narrow roads, shorten drives, and promote multiple uses of public facilities, so as to reduce the need for additional parking lots and structures
        - Disconnect imperviousness so that smaller impervious areas drain to pervious, generally vegetated, areas
        - Use permeable pavers for walkways and low-traffic areas
        - Capture runoff close to the source through the use of rain barrels, bioretention basins, pocket wetlands, grassed swales, flow spreaders and other BMPs that retain the storm water runoff from smaller, more frequent storms, thus reducing the size of regional storm water BMPs
    - Detention or retention storm water ponds
    - Man-made wetlands (runoff could not be diverted to natural wetlands for storm water management)
    - Restored riparian buffers for management of nonpoint (unconcentrated) runoff, following coordination with local regulators when within RPA
    - Site-specific controls, such as linear sand filters or biofilters for water quality management of hot spot areas such as parking lots
- Develop various scenarios that integrate storm water BMPs, including LID, and evaluate their relative effectiveness in managing storm water runoff quantity and quality control.
- Incorporate stream restoration practices into designs of BRAC projects on Main Post

- Participate in Fairfax County's Watershed Planning Process and in TMDL studies with VDEQ to identify potential sources of pollutants of concern and reduce pollutant loads as necessary to meet water quality standards. Watershed management plans will be developed for watersheds that drain Fort Belvoir in the future by Fairfax County in cooperation with local stakeholders. Also, Fort Belvoir's 2007 MS4 permit reissuance should continue to require technical review of construction projects for the evaluation of plans and design documents in accordance with Virginia's SWM regulations, the Virginia Erosion and Sediment Control Handbook, Fairfax County's PFM, and other applicable regulations.

Mitigation

Subwatersheds that would be expected to have increases in storm water runoff were identified in Section 4.7.2.1.2. The following measure could be used to mitigate potential problems.

- Develop a storm water drainage system master plan study. This study would identify current deficiencies (e.g. capacity problems, outfall problems, stream bank erosion) and determine infrastructure needs to meet BRAC requirements and long-term growth to 2030.

4.7.2.4.2 Groundwater Quality

The potential for groundwater contamination and decreased recharge would be minimized by developing BMPs and LID practices designed to reduce pollutants and increase infiltration. Plant and soil processes can help reduce pollutant concentrations in groundwater. Bioretention facilities and other storm water treatment practices would be constructed where practicable to increase groundwater recharge and provide other water quality benefits. Since mitigation and BMPs for surface water would benefit groundwater, refer to Section 4.7.2.4.1 for specific measures.

4.7.2.4.3 Water Resources Protection

Final siting of Preferred Alternative projects would be outside of designated RPAs, wetlands, and floodplains to the maximum extent practicable. BMP and LID practices would include water quality control in their design, where possible. Long-term water resource and storm water protection strategies would incorporate structural, nonstructural, and policy strategies designed to mitigate storm water effects and encroachment into environmentally sensitive areas. Since mitigation and BMPs for surface water would benefit water resources protection, refer to Section 4.7.2.4.1 for specific measures.

4.7.3 ENVIRONMENTAL CONSEQUENCES OF THE TOWN CENTER ALTERNATIVE

4.7.3.1 Surface Water Quality

4.7.3.1.1 Land Use Plan Update

Short- and long-term minor adverse effects to surface water quality, ground water quality, and water resources protection would be expected at the watershed scale; however, localized effects could be more pronounced. Construction of facilities and infrastructure as a result of changes in land use designations could result in increased runoff due to an overall increase in impervious surface area, increased erosion, and increased sediment and pollutant loads. A reduction in pervious area may reduce infiltration and groundwater levels which can cause increases in pollutant concentrations in surface runoff. Decreased infiltration can also lead to lower stream baseflow conditions during dry periods. RPAs and riparian buffers also extend into areas proposed for land use designation changes. Encroachment into these areas decreases the buffer between developed land and sensitive natural resources.

Table 4.7-11 presents the land use changes that could have an impact on water resources (i.e., land use change from undeveloped to developed). Section 4.7.3.1.2 provides a detailed analysis of the potential effects to surface water quality from short- and long-range development projects.

Table 4.7-11
Potential land use plan effects to water resources under the Town Center Alternative

Proposed change	Water resources present in area	Potential effects
North Post–convert Environmentally Sensitive and Outdoor Recreation land uses to Professional/Institutional, Community, Training, and Residential	RPAs, riparian areas, and flood zones along Mason Run and tributaries	Encroachment of development near RPAs and riparian areas. Increased area of impervious surfaces would increase runoff, erosion, and pollutant and sediment loads. Reduction in pervious surfaces would reduce ground absorption of runoff, thereby reducing flow to existing groundwater seeps, where present
Convert South Post golf course (Recreation land use) on South Post into Professional/Institutional	Apart from storm water drainage features, no notable water resources present	Increased area of impervious surfaces would increase runoff, erosion, and pollutant and sediment loads and would reduce ground absorption of runoff, thereby reducing flow to existing groundwater seeps, where present.
South Post eastern and southern areas–convert Environmentally Sensitive and Outdoor Recreation land uses to Professional/Institutional, Community, Training, and Residential	On the South Post plateau, apart from storm water drainage features, no notable water resources present	Increased area of impervious surfaces would increase runoff, erosion, and pollutant and sediment loads and would reduce ground absorption of runoff, thereby reducing flow to existing groundwater seeps, where present.

4.7.3.1.2 BRAC Implementation and Facilities Projects

Storm water

Short- and long-term minor adverse effects would be expected at the watershed scale; however, localized effects could be more pronounced. To comply with federal, state, and installation requirements, Fort Belvoir would minimize potential effects through effective storm water planning, developing adequate infrastructure, and using BMPs. Storm water requirements are addressed under the VPDES program, which includes the development of comprehensive SWPPPs that describe the BMPs to be used to minimize runoff and soil erosion from each construction site and Virginia's Erosion and Sediment Control Regulations. Fort Belvoir's storm water permits (general permits and MS4) regulate storm water discharges on the installation. The state reviews and oversees implementation of the required storm water practices. Note that, in the absence of state-required storm water management practices and erosion control measures being implemented on a watershed basis, short- and long-term effects would be much greater in severity.

Approximately 55 acres of high-intensity and 261 acres of medium-intensity development would be added to the installation by implementing the Town Center Alternative projects. High-intensity development includes areas where people work or reside in high numbers (e.g. apartment complexes and commercial/industrial areas). Medium-intensity includes a mixture of developed and nondeveloped land with impervious cover occupying 50-80 percent of the total land area. Impervious surfaces would increase substantially in Subwatersheds 1 (173 percent), 3 (36 percent), 25 (82 percent), 29 (31 percent), 30 (53 percent), and 32 (75 percent). Increased

impervious surface associated with development typically causes an increase in volume, velocity, and peak flow rates of runoff to nearby streams. Stream channels naturally attempt to accommodate the increased flows by increasing their cross-sectional area. This occurs through erosion of stream banks or down-cutting of the channel beds.

Virginia's Storm Water Management (SWM) Regulations specify evaluating storm water runoff using 2-year or 1-year storm event data in order to assess potential erosion problems and channel adequacy. These regulations also include the requirement for an adequate outfall analysis or use of 1-year, 24-hour extended detention to protect receiving waters. Increased volume might translate to flooding where the stream channel is not adequate to contain the flow. During the 10-year, 24-hour storm event, an increase in volume increases the potential for bank overtopping and flooding. Virginia's Erosion and Sediment Control Regulations (4VAC50-30-40.19) and SWM Regulations (4VAC3-20-81) require that, "downstream channels and properties be protected from erosion and damage due to increases in volume, velocity and peak flow rate." Because of this, site-specific BMPs or mitigation measures would be required for each construction site. A watershed-based approach would be implemented to evaluate upstream and downstream concerns and mitigate possible effects. As discussed above, BMPs and potential mitigation efforts were not included in the following analyses. The types of BMPs that will be implemented and other storm water control activities will depend on final site/parcel development plans.

The 1-year and the 10-year, 24-hour storm events were modeled using the Technical Release 55 (TR-55) model, developed by the NRCS (1986), to evaluate potential changes in peak flows as a result of the Town Center Alternative in each subwatershed. These storm events are identified in Virginia's Erosion and Sediment Control Regulations. These regulations require that properties and waterways be protected from damages from flooding due to increases in volume, velocity and peak flow rates. The 10-year, post-development peak discharge flow rate is not to exceed the 10-year, pre-development peak rate (4VAC50-30-40.19). The threshold used to determine potential adverse effects for this analysis was a 10 percent increase in peak flow occurring from a 1-year, 24-hour and a 10-year, 24-hour storm event. Subwatersheds 1, 3, 25, 29, 30, and 32 would all be expected to have greater than a 10 percent increase in peak flow during the 1-year storm event under the Town Center Alternative, with Subwatershed 1 experiencing the highest percent increase (131 percent). Table 4.7-12 lists the percent increase in peak flow from a 1-year, 24-hour storm event for each subwatershed and the proposed construction projects that would affect runoff. All these subwatersheds, except for Subwatershed 32 would also experience at least a 10 percent increase in peak discharge during a 10-year, 24-hour storm event, indicating there would be a moderate to high increase in flood levels (Table 4.7-12). Table F-1 in Appendix F lists the peak flow percent increase for each subwatershed if the Town Center Alternative projects were implemented.

Sediment

Short- and long-term minor adverse effects would be expected at the watershed scale; however, localized effects could be more pronounced. To comply with federal, state, and installation requirements, Fort Belvoir would minimize potential erosion and sedimentation effects through storm water planning, development of adequate infrastructure, and the use of BMPs. During the initial development phase, proper erosion and sediment controls would be used to manage construction activities that could result in an increase in the sedimentation in adjacent waterbodies. A VPDES permit would be required for construction projects disturbing at least 2,500 square feet. A soil erosion and sediment control plan as well as a SWPPP would be required to provide guidance for reducing sedimentation effects during the construction process. In the long-term, an increase in storm water volume from impervious surfaces could result in an

Table 4.7-12
Subwatersheds with greater than 10 Percent increase in 1-year or 10-year storm event peak discharge under the Town Center Alternative

Subwatershed number	Percent increase in 1-year storm event peak discharge	Percent increase in 10-year storm event peak discharge	Affecting projects
1	131%	75%	NGA, WHS, CDCs, AMC Relocatables, Infrastructure
3	22%	10%	NGA, WHS, CDCs, AMC Relocatables, Infrastructure
25	36%	16%	NGA, WHS
29	25%	13%	NGA, WHS, MDA, Hospital, Dental Clinic, NARMC HQ Bldg, Infrastructure, Network Ops–PEO EIS, PEO EIS Administrative Facility,
30	24%	10%	MDA, Hospital, Dental Clinic, NARMC HQ Bldg, Infrastructure, Network Ops–PEO EIS, Access Control Point, PEO EIS Administrative Facility, Modernize Barracks, Corps Integration Office

increase in erosion and sedimentation. Proper storm water controls, as discussed above, would be implemented as part of the development to minimize the potential effects of increased sediment loads during wet-weather events.

Fort Belvoir was surveyed to characterize watershed conditions and identify erosion problem site locations in 1999, and monitoring of these sites has occurred since (Landgraf, 2003). Table 4.7-13 lists the Town Center Alternative projects that are within close proximity (150 feet) of the previously identified erosion and other problem sites in each watershed. Construction activities and impervious surfaces could increase sediment and storm water runoff into waterbodies, thereby exacerbating erosion and other stream effects at these sites. Eleven projects have existing erosion sites and other stream effects within 150 feet of their footprint. These projects could affect one or more existing problem areas due to an increase in impervious surfaces and resulting storm water from each site. Other projects have few or no erosion/problem sites in the vicinity and would have minimal or no effect on stream bank erosion and other characteristics.

Other Pollutants

Short- and long-term minor adverse effects would be expected at the watershed scale; however, localized effects could be more pronounced. During the initial development phase, construction activities could result in an increase in sediment loading, dissolved solids, petroleum hydrocarbons, and other pollutants in adjacent waterbodies. Measurable effects would be expected to be minimal because the installation would comply with federal, state, and installation regulations and necessary permits for storm water control would be obtained. Site-specific SWPPPs describing the BMPs to be used to minimize effects from increased runoff during site construction would be prepared.

In the long-term, an increase in storm water volume from additional impervious surfaces could result in an increase in nutrients, metals, and other potential contaminants in waterbodies. Proper storm water controls, as discussed above, would be implemented as part of the development to minimize the potential effects of pollutant loading during wet-weather events. Implementing LID techniques would also be used, where possible, to manage the hydrology and quality of storm water runoff from impervious surfaces to reduce this adverse effect.

Table 4.7-13
Projects located within proximity of erosion and other problem sites under the Town Center Alternative

Project number (see Table 2-3)	Project description	Watershed number	Nearby watersheds	Erosion impacted sites within 150 feet
1	NGA	1	Trib. to Accotink Creek	2 blocked pipe, 1 corroded or corrupt pipe, 2 down-cutting low, 1 down-cutting medium, 2 gully, 3 scour hole, 2 undercut structure low
3	MDA Facility	29	Trib. to Accotink Creek	1 bank erosion medium, 1 blocked pipe, 1 down cutting low, 1 down-cutting medium, 1 down-cutting severe, 1 gully, 1 undercut structure low
4	Hospital	29, 30	Trib. to Accotink Creek, Mason Run	3 bank erosion low, 3 bank erosion medium, 4 blocked pipe, 2 corroded or corrupt pipe, 6 down-cutting low, 6 down-cutting medium, 1 down-cutting severe, 1 gully, 1 sediment deposition, 3 undercut structure low
5	Dental Clinic	29, 30	Trib. to Accotink Creek, Mason Run	3 bank erosion low, 3 bank erosion medium, 4 blocked pipe, 2 corroded or corrupt pipe, 6 down-cutting low, 6 down-cutting medium, 1 down-cutting severe, 1 gully, 1 sediment deposition, 2 undercut structure low
8	Infrastructure	29, 30	Trib. to Accotink Creek, Mason Run	3 bank erosion low, 3 bank erosion medium, 4 blocked pipe, 2 corroded or corrupt pipe, 6 down-cutting low, 6 down-cutting medium, 1 down-cutting severe, 1 gully, 1 sediment deposition, 2 undercut structure low
8	Gunston Road Improvement (Infrastructure)	1, 3, 29, 30	Trib. to Accotink Creek, Mason Run	2 bank erosion severe, 4 blocked pipe, 1 corrected sites, 4 down-cutting low, 4 down-cutting medium, 2 down-cutting severe, 3 scour hole, 1 sediment deposition, 1 undercut structure low, 3 undercut structure medium, 2 undercut structure severe
10	Network Ops Center	29, 30	Trib. to Accotink Creek, Mason Run	3 bank erosion low, 3 bank erosion medium, 4 blocked pipe, 2 corroded or corrupt pipe, 6 down-cutting low, 6 down-cutting medium, 1 down-cutting severe, 1 gully, 1 sediment deposition, 2 undercut structure low
12	Child Development Center (NGA)	1	Trib. to Accotink Creek	3 blocked pipe, 1 corroded or corrupt pipe, 3 down-cutting low, 1 down-cutting medium, 2 gully, 4 scour hole, 3 undercut structure low
13	Child Development Center	1	Trib. to Accotink Creek	2 blocked pipe, 1 corroded or corrupt pipe, 2 down-cutting low, 1 down-cutting medium, 2 gully, 3 scour hole, 2 undercut structure low
16	AMC Relocatables	1	Trib. to Accotink Creek	2 blocked pipe, 1 corroded or corrupt pipe, 2 down-cutting low, 1 down-cutting medium, 2 gully, 3 scour hole, 2 undercut structure low
17	PEO EIS Admin. Facility	29, 30	Trib. to Accotink Creek, Mason Run	3 bank erosion low, 3 bank erosion medium, 4 blocked pipe, 2 corroded or corrupt pipe, 6 down-cutting low, 6 down-cutting medium, 1 down-cutting severe, 1 gully, 1 sediment deposition, 2 undercut structure low

Nutrients, such as TN and TP, are parameters of concern according to the Chesapeake Bay agreement. TN loading from land to streams is influenced by using fertilizers, presence of animal waste, and faulty septic systems, as well as by natural sources. Urban, agricultural, and barren land uses are the primary contributors. Nitrogen contributes to low DO levels through bacterial activity and could be toxic to aquatic life. TP loading from land to streams is influenced by using

fertilizers and the presence of animal waste, as well as by natural sources. Urban and agricultural land uses are the primary contributors. Phosphorus is typically the limiting nutrient in freshwater systems and could accelerate waterbody eutrophication.

Potential increases in nutrient loads in Fort Belvoir subwatersheds as a result of the Town Center Alternative were calculated using land use-specific loading coefficients. Loading coefficients were developed based on the watershed modeling results for Accotink Creek using the GWLF model (Haith and Shoemaker, 1987; Haith, Mandel, and Wu, 1992; Dai et al., 2000). GWLF was used to compute the nutrient loads contributed by various land uses in each of the subwatersheds that drain Fort Belvoir. A detailed description of the GWLF model and its capabilities is presented in Appendix F.

Using the land use distributions and applying the associated loading ratios, the average annual percent change in TN and TP loading was calculated for each subwatershed. Subwatersheds with greater than a 10-percent change in nitrogen and phosphorus loads as a result of the Town Center Alternative are shown in Table 4.7-14. Proposed construction projects in each subwatershed that would affect nitrogen and phosphorus loading are also shown in this table. Table F-2 in Appendix F shows the percent change for each subwatershed.

Table 4.7-14
Subwatersheds with greater than 10-percent increase in TN and TP loads under the Town Center Alternative

Subwatershed number	Percent increase in TP	Percent increase in TN	Affecting projects
1	9%	15%	NGA, WHS, CDCs, AMC Relocatables, Infrastructure

4.7.3.2 Groundwater Quality

4.7.3.2.1 Land Use Plan Update

Short- and long-term effects on groundwater quality are presented in Section 4.7.3.1.1

4.7.3.2.2 BRAC Implementation and Facilities Projects

Long-term indirect minor adverse effects would be expected at the watershed scale; however, localized effects could be more pronounced. Approximately 142 acres would be converted to impervious surfaces under the Town Center Alternative. Much of this acreage is on an upland plateau, which follows the I-95 corridor and serves as a groundwater recharge area. The reduction in pervious surfaces would reduce the absorption of runoff into the ground, and therefore reduce flow to existing groundwater seeps, such as the rare coastal plain/piedmont acidic seepage swamp communities scattered around the installation (Fort Belvoir DPW ENRD, 2002). Seepage swamp communities might be affected by projects within close proximity, depending on groundwater flow patterns. The Gunston Road Improvements site (part of Infrastructure, Project #8) is the only project located within 200 feet of a seepage swamp community. In addition, infiltration of increased storm water runoff into the groundwater in other areas could increase nitrogen loads and other contaminants such as soluble metals. Absorption loss and infiltration of pollutants could partially be alleviated through installing BMPs that facilitate infiltration to groundwater, such as bioretention facilities planted with native, wet-tolerant plants (Davis, 2004; Fort Belvoir

2003). Groundwater withdrawal for potable water supply would not be adversely affected by the Town Center Alternative because, although an aquifer containing potentially potable groundwater is present below Fort Belvoir, it is not used for drinking water supply. In addition, the Town Center Alternative would not include installation or removal of any septic tanks.

4.7.3.3 Water Resources Protection

4.7.3.3.1 Land Use Plan Update

Short- and long-term effects on water resources protection are presented in Section 4.7.3.1.1.

4.7.3.3.2 BRAC Implementation and Facilities Projects

Short and long-term effects on water resources regulated under Chesapeake Bay, CZMA, and floodplain protection programs would be similar to those described in Section 4.7.2.3.2. Long-term minor adverse effects would be expected at the watershed scale; however, localized effects could be more pronounced. New construction would be expected to increase impervious surfaces in several subwatersheds. Approximately 7 acres of Chesapeake Bay RPAs would be encroached upon by the following projects under the Town Center Alternative (Table 4.7-15): NGA (Project #1), WHS (Project #2), Hospital (Project #4), Dental Clinic (Project #5), NARMC HQ(Project # 6), MDA (Project #3), Gunston Road Improvements (Project #8), Network Ops-PEO EIS (Project #10) Infrastructure(Project #8), and PEO EIS Admin Facility (Project # 17). Wetlands could also be affected under the Town Center Alternative. Effects on wetlands are further discussed in Section 4.8 (Biological Resources). None of the projects under the Town Center Alternative would affect floodplains.

Table 4.7-15
Affected RPAs in the Town Center Alternative

Area (Acres)	Projects affecting RPAs
4.6	Hospital, Network Ops-PEO EIS, PEO EIS Admin Facility, NARMC HQ Bldg, Infrastructure
2.7	Infrastructure (Gunston Rd. Improvements)
0.1	NGA, WHS
7.4	**Total**

4.7.3.4 BMPs/Mitigation

BMPs and proposed mitigation measures would be similar to those discussed under the Preferred Alternative (Section 4.7.2.4).

4.7.4 ENVIRONMENTAL CONSEQUENCES OF THE CITY CENTER ALTERNATIVE

4.7.4.1 Surface Water Quality

4.7.4.1.1 Land Use Plan Update

Short- and long-term minor adverse effects to surface water quality, ground water quality, and water resources protection would be expected at the watershed scale; however, localized effects

could be more pronounced. Construction of facilities and infrastructure as a result of changes in land use designations could result in increased runoff due to an overall increase in impervious surface area, increased erosion, and increased sediment and pollutant loads. A reduction in pervious area may reduce infiltration and groundwater levels which can cause increases in pollutant concentrations in surface runoff. Decreased infiltration can also lead to lower stream baseflow conditions during dry periods. RPAs and riparian buffers also extend into areas proposed for land use designation changes. Encroachment into these areas decreases the buffer between developed land and sensitive natural resources. In addition, proposed infrastructure projects include a new bridge crossing over Accotink Creek and the replacement of existing bridges over Accotink Creek and Dogue Creek. Bridge construction and repairs will require the issuance of a Corps of Engineers Section 404 permit and a VWP permit by VDEQ.

Table 4.7-16 presents the land use changes that could have an impact on water resources (i.e., land use change from undeveloped to developed). Section 4.7.4.1.2 provides a detailed analysis of the potential effects to surface water quality from short- and long-range development projects.

Table 4.7-16
Potential land use plan effects to water resources under the City Center Alternative

Proposed change	Water resources present in area	Potential effects
Develop Administrative Center on EPG for NGA as well as hospital complex; convert land use designation from Training to Professional/Institutional and Community	RPAs and riparian areas extend into EPG east and the proposed Remote Delivery Facility on EPG west along tributaries of Accotink Creek and the creek along the eastern boundary of EPG	Encroachment of development near RPAs and riparian areas. Increased area of impervious surfaces would increase runoff, erosion, and pollutant and sediment loads. Reduction in pervious surfaces would reduce ground absorption of runoff, thereby reducing flow to existing groundwater seeps, where present
South Post–convert Environmentally Sensitive and Outdoor Recreation land uses to Professional/Institutional, Community, Training, and Residential	On the South Post plateau, apart from storm water drainage features, no notable water resources present	Increased area of impervious surfaces would increase runoff, erosion, and pollutant and sediment loads and would reduce ground absorption of runoff, thereby reducing flow to existing groundwater seeps, where present.
North Post–convert Environmentally Sensitive and Outdoor Recreation land uses to Professional/Institutional, Community, Training, and Residential	RPAs, riparian areas, and flood zones along Mason Run and tributaries	Encroachment of development near RPAs and riparian areas. Increased area of impervious surfaces would increase runoff, erosion, and pollutant and sediment loads and would reduce ground absorption of runoff, thereby reducing flow to existing groundwater seeps, where present.
GSA Parcel becomes Professional/Institutional	Apart from storm water drainage features, no notable water resources present	Increased area of impervious surfaces would increase runoff, erosion, and pollutant and sediment loads and would reduce ground absorption of runoff, thereby reducing flow to existing groundwater seeps, where present.

4.7.4.1.2 BRAC Implementation and Facilities Projects

Storm water

Short- and long-term minor adverse effects would be expected at the watershed scale; however, localized effects could be more pronounced. To comply with federal, state, and installation requirements, Fort Belvoir would minimize potential effects through effective storm water planning, developing adequate infrastructure, and using BMPs. Storm water requirements are addressed under the NPDES program, which includes developing comprehensive SWPPPs that describe the BMPs to be used to minimize runoff and soil erosion from each construction site and Virginia's Erosion and Sediment Control Regulations. Fort Belvoir's storm water permits (general permits and MS4) regulate storm water discharges on the installation. The state reviews and oversees implementation of the required storm water practices. Note that in the absence of state-required storm water management practices and erosion control measures being implemented on a watershed basis, short- and long-term effects would be much greater in severity.

Approximately 86 acres of high-intensity and 173 acres of medium-intensity development would be added to the installation by implementing the City Center Alternative projects. High-intensity development includes areas where people work or reside in high numbers (e.g. apartment complexes and commercial/industrial areas). Medium-intensity includes a mixture of developed and nondeveloped land with impervious cover occupying 50-80 percent of the total land area. Impervious surfaces would increase substantially in Subwatersheds 1 (9 percent), 53 (938 percent), 54 (321 percent), 55 (328 percent), 57 (288 percent), 58 (183 percent), and 59 (135 percent). Increased impervious surface associated with development typically causes an increase in volume, velocity, and peak flow rates of runoff to nearby streams. Stream channels naturally attempt to accommodate the increased flows by increasing their cross-sectional area. This occurs through erosion of stream banks or down-cutting of the channel beds.

Virginia's Storm Water Management (SWM) Regulations specify evaluating storm water runoff using 2-year or 1-year storm event data in order to assess potential erosion problems and channel adequacy. These regulations also include the requirement for an adequate outfall analysis or use of 1-year, 24-hour extended detention to protect receiving waters. Increased volume might translate to flooding where the stream channel is not adequate to contain the flow. During the 10-year, 24-hour storm event, an increase in volume increases the potential for bank overtopping and flooding. Virginia's Erosion and Sediment Control Regulations (4VAC50-30-40.19) and SWM Regulations (4VAC3-20-81) require that, "downstream channels and properties be protected from erosion and damage due to increases in volume, velocity and peak flow rate." Because of this, site-specific BMPs or mitigation measures would be required for each construction site. A watershed-based approach would be implemented to evaluate upstream and downstream concerns and mitigate possible effects. As discussed above, BMPs and potential mitigation efforts were not included in the following analyses. The types of BMPs that will be implemented and other storm water control activities will depend on final site/parcel development plans.

The 1-year and the 10-year, 24-hour storm events were modeled using the Technical Release 55 (TR-55) model, developed by the NRCS (1986), to evaluate potential changes in peak flows as a result of the City Center Alternative in each subwatershed. These storm events are identified in Virginia's Erosion and Sediment Control Regulations. These regulations require that properties and waterways be protected from damages from flooding due to increases in volume, velocity and

peak flow rates. The 10-year, post-development peak discharge flow rate is not to exceed the 10-year, pre-development peak rate (4VAC50-30-40.19). The threshold used to determine potential adverse effects for this analysis was a 10-percent increase in peak flow occurring from a 1-year, 24-hour and a 10-year, 24-hour storm event. Subwatersheds 1, 53, 54, 55, 57, 58, and 59 would all be expected to have greater than a 10-percent increase in peak flow during the 1-year storm event under the City Center Alternative, with Subwatershed 57 experiencing the highest percent increase (93 percent). Table 4.7-17 lists the percent increase in peak flow from a 1-year, 24-hour storm event for each subwatershed and the proposed construction projects that would affect runoff. All these subwatersheds, except for Subwatersheds 1 and 54 would also experience at least a 10-percent increase in peak discharge during a 10-year, 24-hour storm event, indicating there would be a moderate to high increase in flood levels (Table 4.7-17). Table F-1 in Appendix F lists the peak flow percent increase for each subwatershed if the City Center Alternative projects were implemented.

Table 4.7-17
Subwatersheds with greater than 10 percent increase in 1-year or 10-year storm event peak discharge under the City Center Alternative

Subwatershed number	Percent increase in 1-year storm event peak discharge	Percent increase in 10-year storm event peak discharge	Affecting projects
1	10%	<10%	AMC Relocatables, Infrastructure
53	77%	22%	NGA, Infrastructure
54	14%	<10%	Infrastructure
55	53%	17%	Infrastructure
57	93%	32%	NGA, CDC (NGA), MDA, Infrastructure, Corps Integration Office
58	70%	31%	NGA, Hospital, Dental Clinic, NARMC HQ Bldg, Infrastructure, Emergency Services Center (EPG), WHS, PEO EIS Administrative Facility, Corps Integration Office
59	82%	34%	NGA, Hospital, Infrastructure, PEO EIS Administrative Facility, NARMC HQ Bldg, WHS, CDC (EPG)

Sediment

Short- and long-term minor adverse effects would be expected at the watershed scale; however, localized effects could be more pronounced. To comply with federal, state, and installation requirements, Fort Belvoir would minimize potential erosion and sedimentation effects through storm water planning, development of adequate infrastructure, and the use of BMPs. During the initial development phase, proper erosion and sediment controls would be used to manage construction activities that could result in an increase in the sedimentation in adjacent waterbodies. A VPDES permit would be required for construction projects disturbing at least 2,500 square feet. A soil erosion and sediment control plan as well as a SWPPP would be required to provide guidance for reducing sedimentation effects during the construction process. In the long-term, an increase in storm water volume from impervious surfaces could result in an increase in erosion and sedimentation. Proper storm water controls, as discussed above, would be implemented as part of the development to minimize the potential effects of increased sediment loads during wet-weather events.

Fort Belvoir was surveyed to characterize watershed conditions and identify erosion problem site locations in 1999, and monitoring of these sites has occurred since (Landgraf, 2003). Table 4.7-18 lists the City Center Alternative projects that are within close proximity (150 feet) of the previously identified erosion and other problem sites in each watershed. Construction activities and impervious surfaces could increase sediment and storm water runoff into waterbodies, thereby exacerbating erosion and other stream effects at these sites. Ten City Center projects have existing erosion sites and other stream effects within 150 feet of their footprint. These projects could affect one or more existing problem areas due an increase in impervious surfaces and resulting storm water from each site. Other projects have few or no erosion/problem sites in the vicinity and would have minimal or no effect on stream bank erosion and other characteristics.

Other Pollutants

Short- and long-term minor adverse effects would be expected at the watershed scale; however, localized effects could be more pronounced. During the initial development phase, construction activities could result in an increase in sediment loading, dissolved solids, petroleum hydrocarbons, and other pollutants in adjacent waterbodies. Measurable effects would be expected to be minimal because the installation would comply with federal, state, and installation regulations and necessary permits for storm water control would be obtained. Site-specific SWPPPs describing the BMPs to be used to minimize effects from increased runoff during site construction would be prepared.

In the long-term, an increase in storm water volume from additional impervious surfaces could result in an increase in nutrients, metals, and other potential contaminants in waterbodies. Proper storm water controls, as discussed above, would be implemented as part of the development to minimize the potential effects of pollutant loading during wet-weather events. Implementing LID techniques would also be used, where possible, to manage the hydrology and quality of storm water runoff from impervious surfaces to reduce this adverse effect.

Nutrients, such as TN and TP, are parameters of concern according to the Chesapeake Bay agreement. TN loading from land to streams is influenced by using fertilizers, presence of animal waste, and faulty septic systems, as well as by natural sources. Urban, agricultural, and barren land uses are the primary contributors. Nitrogen contributes to low DO levels through bacterial activity and could be toxic to aquatic life. TP loading from land to streams is influenced by using fertilizers and the presence of animal waste, as well as by natural sources. Urban and agricultural land uses are the primary contributors. Phosphorus is typically the limiting nutrient in freshwater systems and could accelerate waterbody eutrophication.

Potential increases in nutrient loads in Fort Belvoir subwatersheds as a result of the City Center Alternative were calculated using land use-specific loading coefficients. Loading coefficients were developed based on the watershed modeling results for Accotink Creek using the GWLF model (Haith and Shoemaker, 1987; Haith, Mandel, and Wu, 1992; Dai et al., 2000). GWLF was used to compute the nutrient loads contributed by various land uses in each of the subwatersheds that drain Fort Belvoir. A detailed description of the GWLF model and its capabilities is presented in Appendix F.

Table 4.7-18
Projects located within proximity of erosion and other problem sites under the City Center Alternative

Project number (see Table 2-3)	Project description	Watershed number(s)	Nearby watersheds	Erosion impacted sites within 150 feet
1	NGA	53, 59	Accotink Cr., trib. to Accotink Cr.	1 blocked pipe, 4 corroded or corrupt pipe, 1 gully, 1 scour hole, 2 undercut structure low
4	Hospital	58, 59	Field Lark Branch, trib. to Accotink Creek	1 bank erosion medium, 2 blocked pipe, 2 corroded or corrupt pipe, 8 down-cutting low, 3 down-cutting medium, 1 down-cutting severe, 1 scour hole, 1 sediment deposition, 1 undercut structure low, 2 undercut structure medium, 1 undercut structure severe
5	Dental Clinic	58, 59	Field Lark Branch, trib. to Accotink Creek	1 bank erosion medium, 2 blocked pipe, 2 corroded or corrupt pipe, 6 down-cutting low, 2 down-cutting medium, 1 down-cutting severe, 1 scour hole, 1 sediment deposition, 1 undercut structure low, 1 undercut structure medium, 1 undercut structure severe
6	NARMC Headquarters Building	58, 59	Field Lark Branch, trib. to Accotink Creek	1 bank erosion medium, 2 blocked pipe, 2 corroded or corrupt pipe, 6 down-cutting low, 2 down-cutting medium, 1 down-cutting severe, 1 scour hole, 1 sediment deposition, 1 undercut structure low, 1 undercut structure medium, 1 undercut structure severe
8	Infrastructure	53, 54, 55, 57, 58, 59	Accotink Creek, Field Lark Branch, trib. to Accotink Creek	3 bank erosion low, 11 bank erosion medium, 4 bank erosion severe, 5 blocked pipe, 7 corroded or corrupt pipe, 11 down-cutting low, 3 down-cutting medium, 2 down-cutting severe, 2 gully, 9 scour hole, 3 sediment deposition, 2 undercut structure medium, 1 undercut structure severe
8	Gunston Road Improvements (Infrastructure)	1, 3, 29, 30	Trib. to Accotink Creek, Mason Run	2 bank erosion severe, 4 blocked pipe, 1 corrected sites, 4 down-cutting low, 4 down-cutting medium, 2 down-cutting severe, 3 scour hole, 1 sediment deposition, 1 undercut structure low, 3 undercut structure medium, 2 undercut structure severe
9	Emergency Service Center (EPG)	58, 59	Field Lark Branch, trib. to Accotink Creek	1 bank erosion medium, 2 blocked pipe, 2 corroded or corrupt pipe, 6 down-cutting low, 2 down-cutting medium, 1 down-cutting severe, 1 scour hole, 1 sediment deposition, 1 undercut structure low, 1 undercut structure medium, 1 undercut structure severe
10	Network Ops Center	53, 59	Accotink Cr., trib. to Accotink Cr.	1 blocked pipe, 3 corroded or corrupt pipe, 1 gully, 1 scour hole, 2 undercut structure low
12	Child Development Center (NGA)	53, 59	Accotink Cr., trib. to Accotink Cr.	1 blocked pipe, 3 corroded or corrupt pipe, 1 gully, 1 scour hole, 2 undercut structure low
17	PEO EIS Admin Facility	53, 59	Accotink Cr., trib. to Accotink Cr.	1 blocked pipe, 3 corroded or corrupt pipe, 1 gully, 1 scour hole, 2 undercut structure low

Using the land use distributions and applying the associated loading ratios, the average annual percent change in TN and TP loading was calculated for each subwatershed. Subwatersheds with greater than a 10-percent change in nitrogen and phosphorus loads as a result of the City Center Alternative are shown in Table 4.7-19. Proposed construction projects in each subwatershed that would affect nitrogen and phosphorus loading are also shown in this table. Table F-2 in Appendix F shows the percent change for each subwatershed.

Table 4.7-19
Subwatersheds with greater than 10-percent increase in TN and TP loads under the City Center Alternative

Subwatershed number	Percent increase in TP	Percent increase in TN	Affecting projects
53	61%	83%	NGA, Infrastructure
54	7%	14%	Infrastructure
55	26%	39%	Infrastructure
57	11%	19%	NGA, MDA, Infrastructure, CDC (NGA), Corps Integration Office
58	13%	19%	NGA, Hospital, Dental Clinic, NARMC HQ Bldg, Infrastructure, Emergency Services Center (EPG), WHS, PEO EIS Administrative Facility, Corps Integration Office

4.7.4.2 Groundwater Quality

4.7.4.2.1 Land Use Plan Update

Short- and long-term effects on groundwater quality are presented in Section 4.7.4.1.1.

4.7.4.2.2 BRAC Implementation and Facilities Projects

Long-term indirect minor adverse effects would be expected at the watershed scale; however, localized effects could be more pronounced. Approximately 131 acres would be converted to impervious surfaces under the City Center Alternative. Much of this acreage is on an upland plateau, which follows the I-95 corridor and serves as a groundwater recharge area. The reduction in pervious surfaces would reduce the absorption of runoff into the ground, and therefore reduce flow to existing groundwater seeps, such as the rare coastal plain/piedmont acidic seepage swamp communities scattered around the installation (Fort Belvoir DPW ENRD, 2002). Seepage swamp communities could be affected by projects within close proximity, depending on groundwater flow patterns. The Gunston Road Improvements site (part of Infrastructure, Project #8) is the only project located within 200 feet of a seepage swamp community. In addition, infiltration of increased storm water runoff into the groundwater in other areas could increase nitrogen loads and other contaminants such as soluble metals. Absorption loss and infiltration of pollutants could partially be alleviated through installing BMPs that facilitate infiltration to groundwater, such as bioretention facilities planted with native, wet-tolerant plants (Davis, 2004; Fort Belvoir 2003). Groundwater withdrawal for potable water supply would not be adversely affected by the City Center Alternative because, although an aquifer containing potentially potable groundwater is present below Fort Belvoir, it is not used for drinking water supply. In addition, the City Center Alternative would not include installation or removal of any septic tanks.

4.7.4.3 Water Resources Protection

4.7.4.3.1 Land Use Plan Update

Short- and long-term effects on water resources protection are presented in Section 4.7.4.1.1.

4.7.4.3.2 BRAC Implementation and Facilities Projects

Short and long-term effects on water resources regulated under Chesapeake Bay, CZMA, and floodplain protection programs would be similar to those described in Section 4.7.2.3.2. Long-term minor adverse effects would be expected at the watershed scale; however, localized effects could be more pronounced. New construction would be expected to increase impervious surfaces in several subwatersheds. Approximately 14 acres of Chesapeake Bay RPAs would be affected by seven projects under the City Center Alternative (Table 4.7-20). The following projects encroach into designated RPA areas: Hospital (Project #4), Dental Clinic (Project #5), Emergency Services Center (EPG) (Project #9), NARMC HQ Building (Project #6), Gunston Road Improvements (Project #8), Road and Utility Infrastructure (Project #8), and PEO EIS Admin Facility (Project #17). Wetlands could also be affected under the City Center Alternative. Effects on wetlands are further discussed in Section 4.8 (Biological Resources). In addition, one project under the City Center Alternative would affect floodplains. Approximately 2.9 acres of floodplain would be encroached upon by the Infrastructure project sites (Project # 8).

Table 4.7-20
Affected RPAs in the City Center Alternative

Area (Acres)	Projects affecting RPAs
1.0	Hospital, Emergency Svcs Center (EPG), NARMC HQ Bldg
4.9	Infrastructure (Gunston Road Improvements)
7.9	Infrastructure
0.1	PEO EIS Admin Facility
13.9	**Total**

4.7.4.4 BMPs/Mitigation

BMPs and mitigation measures would be similar to those discussed under the Preferred Alternative (Section 4.7.2.4).

4.7.5 ENVIRONMENTAL CONSEQUENCES OF THE SATELLITE CAMPUSES ALTERNATIVE

4.7.5.1 Surface Water Quality

4.7.5.1.1 Land Use Plan Update

Short- and long-term minor adverse effects to surface water quality, ground water quality, and water resources protection would be expected at the watershed scale; however, localized effects could be more pronounced. Construction of facilities and infrastructure as a result of changes in land use designations could result in increased runoff due to an overall increase in impervious surface area, increased erosion, and increased sediment and pollutant loads. A reduction in pervious area may reduce infiltration and groundwater levels which can cause increases in pollutant concentrations in surface runoff. Decreased infiltration can also lead to lower stream baseflow conditions during dry periods. RPAs and riparian buffers also extend into areas proposed for land use designation changes. Encroachment into these areas decreases the buffer between developed land and sensitive natural resources. Table 4.7-21 presents the land use

changes that could have an impact on water resources (i.e., land use change from undeveloped to developed). Section 4.7.5.1.2 provides a detailed analysis of the potential effects to surface water quality from short- and long-range development projects.

Table 4.7-21
Potential long-range land use plan effects to water resources under the Satellite Campuses Alternative

Proposed change	Water resources present in area	Potential effects
Convert South Post Golf Course (Recreation land use) on South Post into Professional/Institutional	Apart from storm water drainage features, no notable water resources present	Encroachment of development near RPAs and riparian areas. Increased area of impervious surfaces would increase runoff, erosion, and pollutant and sediment loads. Reduction in pervious surfaces would reduce ground absorption of runoff, thereby reducing flow to existing groundwater seeps, where present
South Post eastern and southern areas–convert Environmentally Sensitive and Outdoor Recreation land uses to Professional/Institutional, Community, Training, and Residential	On the South Post plateau, apart from storm water drainage features, no notable water resources present	Increased area of impervious surfaces would increase runoff, erosion, and pollutant and sediment loads and would reduce ground absorption of runoff, thereby reducing flow to existing groundwater seeps, where present.
North Post–convert Environmentally Sensitive and Outdoor Recreation land uses to Professional/Institutional, Community, Training, and Residential	RPAs, riparian areas, and flood zones along Mason Run and tributaries	Encroachment of development near RPAs and riparian areas. Increased area of impervious surfaces would increase runoff, erosion, and pollutant and sediment loads and would reduce ground absorption of runoff, thereby reducing flow to existing groundwater seeps, where present.
Davison Army Airfield (west of Fairfax County Parkway) converted from Airfield to Professional/Institutional	RPAs, riparian areas, and flood zones along Accotink Creek to north and east sides of airfield	Encroachment of development near RPAs and riparian areas; no development would occur within these areas. Increased area of impervious surfaces would increase runoff, erosion, and pollutant and sediment loads and would reduce ground absorption of runoff, thereby reducing flow to existing groundwater seeps, where present.

4.7.5.1.2 BRAC Implementation and Facilities Projects

Storm water

Short- and long-term minor adverse effects would be expected at the watershed scale; however, localized effects could be more pronounced. To comply with federal, state, and installation requirements, Fort Belvoir would minimize potential effects through effective storm water planning, developing adequate infrastructure, and using BMPs. Storm water requirements are addressed under the NPDES program, which includes developing comprehensive SWPPPs that describe the BMPs to be used to minimize runoff and soil erosion from each construction site and Virginia's Erosion and Sediment Control Regulations. Fort Belvoir's storm water permits (general permits and MS4) regulate storm water discharges on the installation. The state reviews

and oversees implementation of the required storm water practices. Note that in the absence of state-required storm water management practices and erosion control measures being implemented on a watershed basis, short- and long-term effects would be much greater in severity.

Approximately 55 acres of high-intensity and 392 acres of medium-intensity development would be added to the installation by implementing the Satellite Campuses Alternative projects. High-intensity development includes areas where people work or reside in high numbers (e.g. apartment complexes and commercial/industrial areas). Medium-intensity includes a mixture of developed and nondeveloped land with impervious cover occupying 50-80 percent of the total land area. Impervious surfaces would increase substantially in Subwatersheds 1 (121 percent), 29 (25 percent), 30 (40 percent), 32 (73 percent), 38 (116 percent), 42 (40 percent), and 43 (239 percent). Increased impervious surface associated with development typically causes an increase in volume, velocity, and peak flow rates of runoff to nearby streams. Stream channels naturally attempt to accommodate the increased flows by increasing their cross-sectional area. This occurs through erosion of stream banks or down-cutting of the channel beds.

Virginia's Storm Water Management (SWM) Regulations specify evaluating storm water runoff using 2-year or 1-year storm event data in order to assess potential erosion problems and channel adequacy. These regulations also include the requirement for an adequate outfall analysis or use of 1-year, 24-hour extended detention to protect receiving waters. Increased volume might translate to flooding where the stream channel is not adequate to contain the flow. During the 10-year, 24-hour storm event, an increase in volume increases the potential for bank overtopping and flooding. Virginia's Erosion and Sediment Control Regulations (4VAC50-30-40.19) and SWM Regulations (4VAC3-20-81) require that, "downstream channels and properties be protected from erosion and damage due to increases in volume, velocity and peak flow rate." Because of this, site-specific BMPs or mitigation measures would be required for each construction site. A watershed-based approach would be implemented to evaluate upstream and downstream concerns and mitigate possible effects. As discussed above, BMPs and potential mitigation efforts were not included in the following analyses. The types of BMPs that will be implemented and other storm water control activities will depend on final site/parcel development plans.

The 1-year and the 10-year, 24-hour storm events were modeled using the Technical Release 55 (TR-55) model, developed by the NRCS (1986), to evaluate potential changes in peak flows as a result of the Satellite Campuses Alternative in each subwatershed. These storm events are identified in Virginia's Erosion and Sediment Control Regulations. These regulations require that properties and waterways be protected from damages from flooding due to increases in volume, velocity, and peak flow rates. The 10-year, post-development peak discharge flow rate is not to exceed the 10-year, pre-development peak rate (4VAC50-30-40.19). The threshold used to determine potential adverse effects for this analysis was a 10 percent increase in peak flow occurring from a 1-year, 24-hour and a 10-year, 24-hour storm event. Subwatersheds 1, 29, 30, 32, 38, 42, and 43 would all be expected to have greater than a 10-percent increase in peak flow during the 1-year storm event under the Satellite Campuses Alternative, with Subwatershed 43 experiencing the highest percent increase (91 percent). Table 4.7-22 lists percent increase in peak flow from a 1-year, 24-hour storm event for each subwatershed and the proposed construction projects that would affect runoff. All these subwatersheds, except for Subwatersheds 32 and 42 would also experience at least a 10-percent increase in peak discharge during a 10-year, 24-hour storm event, indicating there would be a moderate to high increase in flood levels (Table 4.7-22).

Table 4.7-22
Subwatersheds with greater than 10-percent increase in 1-year or 10-year storm event peak discharge under the Satellite Campuses Alternative

Subwatershed number	Percent increase in 1-year storm event peak discharge	Percent increase in 10-year storm event peak discharge	Affecting projects
1	54%	25%	AMC Relocatables, Infrastructure
29	25%	13%	WHS, Infrastructure, CDC, AMC Relocatables
30	25%	10%	WHS, Hospital, Infrastructure, Access Control Point, Network Ops–PEO EIS, PEO EIS Administrative Facility, MDA, Modernize Barracks, Corps Integration Office
32	15%	< 10%	PEO EIS Administrative Facility
38	44%	16%	Hospital, NARMC HQ Bldg
42	17%	< 10%	NGA
43	91%	42%	NGA, CDC (NGA)

Table F-1 in Appendix F lists the peak flow percent increase for each subwatershed if the Satellite Campuses Alternative projects were implemented.

Sediment

Short- and long-term minor adverse effects would be expected at the watershed scale; however, localized effects could be more pronounced. To comply with federal, state, and installation requirements, Fort Belvoir would minimize potential erosion and sedimentation effects through storm water planning, developing adequate infrastructure, using BMPs. During the initial development phase, proper erosion and sediment controls would be used to manage construction activities that could result in an increase in the sedimentation in adjacent waterbodies. A VPDES permit would be required for those projects disturbing at least one acre, and a soil erosion and sediment control plan as well as a SWPPP would be required to provide guidance for reducing sedimentation effects during the construction process. In the long-term, an increase in storm water volume from impervious surfaces could result in an increase in erosion and sedimentation. Proper storm water controls, as discussed above, would be implemented as part of the development to minimize the potential effects of increased sediment loads during wet-weather events.

Fort Belvoir was surveyed to characterize watershed conditions and identify erosion problem site locations in 1999, and monitoring of these sites has occurred since (Landgraf, 2003). Table 4.7-23 lists the Satellite Campuses projects that are within close proximity (150 feet) of the previously identified erosion and other problem sites in each watershed. Construction activities and impervious surfaces could increase sediment and storm water runoff into waterbodies, thereby exacerbating erosion and other stream effects at these sites. Twelve Satellite Campuses projects have existing erosion sites and other stream effects within 150 feet of their footprint. These projects could affect one or more existing problem areas due to an increase in impervious surfaces and resulting storm water from each site. Other projects have few or no erosion/problem sites in the vicinity and would have minimal or no effect on stream bank erosion and other characteristics.

Table 4.7-23
Projects located within proximity of erosion and other problem sites under the Satellite Campuses Alternative

Project number (see Table 2-3)	Project description	Watershed number	Nearby watersheds	Erosion impacted sites within 150 feet
1	NGA	42, 43, 44	Trib. to Accotink Creek	1 bank erosion low, 2 bank erosion medium, 2 bank erosion severe, 5 blocked pipe, 6 down-cutting low, 1 down-cutting medium, 1 down-cutting severe, 3 scour hole, 3 sediment deposition
2	WHS	29, 30	Trib. to Accotink Creek, Mason Run	1 corroded or corrupt pipe, 2 down-cutting low, 3 down-cutting medium, 1 undercut structure low
4	Hospital	38	Trib. to Accotink Creek	2 down-cutting low
5	Dental Clinic	38	Trib. to Accotink Creek	1 down-cutting low
6	NARMC Headquarters Building	38	Trib. to Accotink Creek	2 down-cutting low
8	Infrastructure	29, 30	Trib. to Accotink Creek, Mason Run	1 corroded or corrupt pipe, 1 down-cutting low, 3 down-cutting medium, 1 undercut structure low
8	Gunston Road Improvements (Infrastructure)	1, 3, 29, 30	Trib. to Accotink Creek, Mason Run	2 bank erosion severe, 4 blocked pipe, 1 corrected sites, 4 down-cutting low, 4 down-cutting medium, 2 down-cutting severe, 3 scour hole, 1 sediment deposition, 1 undercut structure low, 3 undercut structure medium, 2 undercut structure severe
10	Network Ops Center	30, 32	Mason Run, trib. to Dogue Creek	4 blocked pipe, 2 down-cutting low, 2 down-cutting medium, 2 down-cutting severe, 3 gully, 1 scour hole, 1 sediment deposition, 1 undercut structure medium
12	Child Development Center (NGA)	42, 43, 44	Trib. to Accotink Creek	1 bank erosion low, 2 bank erosion medium, 2 bank erosion severe, 5 blocked pipe, 6 down-cutting low, 1 down-cutting medium, 1 down-cutting severe, 3 scour hole, 3 sediment deposition
13	Child Development Center	29, 30	Trib. to Accotink Creek, Mason Run	1 corroded or corrupt pipe, 1 down-cutting low, 3 down-cutting medium, 1 undercut structure low
16	AMC Relocatables	1	Trib. to Accotink Creek	2 blocked pipe, 1 corroded or corrupt pipe, 2 down-cutting low, 1 down-cutting medium, 2 gully, 3 scour hole, 2 undercut structure low
17	PEO EIS Facility	30, 32	Mason Run, trib. to Dogue Creek	4 blocked pipe, 2 down cutting low, 3 down cutting medium, 2 down cutting severe, 3 gully, 1 scour hole, 1 sediment deposition, 1 undercut structure medium

Other Pollutants

Short- and long-term minor adverse effects would be expected at the watershed scale; however, localized effects could be more pronounced. During the initial development phase, construction activities could result in an increase in sediment loading, dissolved solids, petroleum hydrocarbons, and other pollutants in adjacent waterbodies. Measurable effects would be expected to be minimal because the installation would comply with federal, state, and installation regulations, and necessary permits for storm water control would be obtained. Site-specific SWPPPs describing the BMPs to be used to minimize effects from increased runoff during site construction would be prepared.

In the long-term, an increase in storm water volume from additional impervious surfaces could result in an increase in nutrients, metals, and other potential contaminants in waterbodies. Proper storm water controls, as discussed above, would be implemented as part of the development to minimize the potential effects of pollutant loading during wet-weather events. Implementing LID techniques would also be used, where possible, to manage the hydrology and quality of storm water runoff from impervious surfaces to reduce this adverse effect.

Nutrients, such as TN and TP, are parameters of concern according to the Chesapeake Bay agreement. TN loading from land to streams is influenced by using fertilizers, presence of animal waste, and faulty septic systems, as well as by natural sources. Urban, agricultural, and barren land uses are the primary contributors. Nitrogen contributes to low DO levels through bacterial activity and could be toxic to aquatic life. TP loading from land to streams is influenced by the use of fertilizers and the presence of animal waste, as well as by natural sources. Urban and agricultural land uses are the primary contributors. Phosphorus is typically the limiting nutrient in freshwater systems and could accelerate waterbody eutrophication.

Potential increases in nutrient loads in Fort Belvoir subwatersheds as a result of the Satellite Campuses Alternative were calculated using land use-specific loading coefficients. Loading coefficients were developed based on the watershed modeling results for Accotink Creek using the GWLF model (Haith and Shoemaker, 1987; Haith, Mandel, and Wu, 1992; Dai et al., 2000). GWLF was used to compute the nutrient loads contributed by various land uses in each of the subwatersheds that drain Fort Belvoir. A detailed description of the GWLF model and its capabilities is presented in Appendix F

Using the land use distributions and applying the associated loading ratios, the average annual percent change in TN and TP loading was calculated for each subwatershed. Subwatersheds with greater than a 10-percent change in nitrogen and phosphorus loads as a result of the Satellite Campuses Alternative are shown in Table 4.7-24. Proposed construction projects in each subwatershed that would affect nitrogen and phosphorus loading are also shown in this table. Table F-2 in Appendix F shows the percent change for each subwatershed.

Table 4.7-24
Subwatersheds with greater than 10-percent increase in TN and TP loads under the Satellite Campuses Alternative

Subwatershed number	Percent increase in TP	Percent increase in TN	Affecting projects
29	12%	13%	WHS, CDC, Infrastructure, AMC Relocatables

4.7.5.2 Groundwater Quality

4.7.5.2.1 Land Use Plan Update

Short- and long-term effects on groundwater quality are presented in Section 4.7.5.1.1.

4.7.5.2.2 BRAC Implementation and Facilities Projects

Long-term indirect minor adverse effects would be expected at the watershed scale; however, localized effects could be more pronounced. Approximately 207 acres would be converted to impervious surfaces under the Satellite Campuses Alternative. Much of this acreage is on an upland plateau, which follows the I-95 corridor and serves as a groundwater recharge area. The reduction in pervious surfaces would reduce the absorption of runoff into the ground, and therefore reduce flow to existing groundwater seeps, such as the rare coastal plain/piedmont acidic seepage swamp communities scattered around the installation (Fort Belvoir DPW ENRD, 2002). Seepage swamp communities could be affected by projects within close proximity, depending on groundwater flow patterns. Four projects are within 200 feet of a seepage swamp community: Network Ops-PEO EIS (Project #10), Gunston Road Improvements (Project #8) and PEO EIS Admin Facility (Project #17). In addition, infiltration of increased storm water runoff into the groundwater in other areas could increase nitrogen loads and other contaminants such as soluble metals. Absorption loss and infiltration of pollutants could partially be alleviated through installing BMPs that facilitate infiltration to groundwater, such as bioretention facilities planted with native, wet-tolerant plants (Davis, 2004; Fort Belvoir 2003). Groundwater withdrawal for potable water supply would not be adversely affected by the Satellite Campuses Alternative because, although an aquifer containing potentially potable groundwater is present below Fort Belvoir, it is not used for drinking water supply. In addition, the Satellite Campuses Alternative would not include installation or removal of any septic tanks.

4.7.5.3 Water Resources Protection

4.7.5.3.1 Land Use Plan Update

Short- and long-term effects on water resources protection are presented in Section 4.7.5.1.1.

4.7.5.3.2 BRAC Implementation and Facilities Projects

Short and long-term effects on water resources regulated under Chesapeake Bay, CZMA, and floodplain protection programs would be similar to those described in Section 4.7.2.3.2. Long-term minor adverse effects would be expected at the watershed scale; however, localized effects could be more pronounced. New construction would be expected to increase impervious surfaces in several subwatersheds. Approximately 40 acres of Chesapeake Bay RPAs would be affected by nine projects under the Satellite Campuses Alternative (Table 4.7-25). The following projects encroach into designated RPA areas: NGA (Project #1), Child Development Centers (Projects #12 and #13), WHS (Project #2), Infrastructure (Project #8), Network Operations–PEO EIS (Project #10), PEO EIS Administrative Facility (Project #17), and Gunston Road Improvements (Project #8). Wetlands could also be affected under the Satellite Campuses Alternative. Effects on wetlands are further discussed in Section 4.8 (Biological Resources). In addition, three projects under the Satellite Campuses Alternative would affect floodplains (Table 4.7-26). Approximately 3.2 acres of floodplain would be encroached upon by the NGA and Child Development Center project sites (#s 12 and 13).

Table 4.7-25
Affected RPAs in the Satellite Campuses Alternative

Area (Acres)	Projects affecting RPAs
29.9	NGA, Child Dev Center – 244 (NGA)
0.1	WHS, Infrastructure, Child Dev Center – 303 (EPG)
6.0	Network Ops – PEO EIS, PEO EIS Admin Facility
0.4	NGA
2.7	Infrastructure (Gunston Road Improvements)
0.3	Child Dev Center – 244 (NGA)
39.4	**Total**

Table 4.7-26
Affected Floodplains in the Satellite Campuses Alternative

Area (Acres)	Projects affecting Floodplains
2.77	NGA, Child Dev Center – 244 (NGA)
0.44	NGA
3.21	**Total**

4.7.5.4 BMPs/Mitigation

BMPs and mitigation measures would be similar to those discussed under the Preferred Alternative (Section 4.7.2.4).

4.7.6 ENVIRONMENTAL CONSEQUENCES OF THE NO ACTION ALTERNATIVE

4.7.6.1 Surface Water Quality

Storm water

No effects on storm water quantity would be expected under the No Action Alternative. The percent of impervious surfaces for each subwatershed on Fort Belvoir would remain unchanged. The quantity of runoff to the surrounding receiving waterbodies would be expected to remain unchanged. The Army would continue to manage Fort Belvoir in accordance with the CWA, Virginia Stormwater Management Act, and act consistently with the Chesapeake Bay Preservation Act, and other applicable laws, regulations, and Army Policy.

Sediment

No effects would be expected. Under the No Action Alternative, natural resources and land management programs would continue to maintain vegetative cover and erosion controls as required by federal, state, local, and Army regulations. Erosion problems on the installation would continue to be identified and remediated.

Other Pollutants

No effects would be expected. During the installation's baseline aquatic survey of the five main perennial waterways, aluminum, manganese, and iron were detected. The USGS NAWQA station for the Potomac River Basin reported that it had high concentrations of nutrients and pesticides, although high levels were not found during the installation's baseline aquatic survey. Existing levels of aluminum, manganese, iron, nutrients, and pesticides would remain unchanged under the No Action Alternative.

4.7.6.2 Groundwater Quality

No effects on groundwater or sensitive seep communities would be expected. The groundwater system below Fort Belvoir is not used as a potable water supply. Effects from implementation of the proposed action on groundwater would not occur.

4.7.6.3 Water Resources Protection

Section 4.7.1.2 and Section 4.7.1.5 provide discussions of federal, state, and local regulations that help protect water resources on Fort Belvoir.

Chesapeake Bay

No effects would be expected. The Army would continue to manage Fort Belvoir in accordance with various Chesapeake Bay agreements as described in Section 4.7.1.5, as well as with federal, state, and local efforts to protect the Chesapeake Bay. No RPAs would be disturbed under the No Action Alternative.

Coastal Zone Management Act

No effects requiring a permit from the Commonwealth of Virginia regulatory programs pertinent to the CZMA would be expected.

Floodplains

No effects on floodplains would be expected under the No Action Alternative.

4.7.6.4 BMPs/Mitigation

Apart from existing mitigation in place, no mitigation measures would be implemented under the No Action Alternative.

4.7.7 SUMMARY OF COMPARISON OF ALTERNATIVES

Regardless of the land use alternative selected, the BRAC action would have minor short- and long-term adverse effects on water resources at the watershed scale, with localized effects that could be more pronounced during the implementation of proposed changes. Each alternative would have varying effects due to the siting of each of the agencies affected by the BRAC action. For example, the Preferred Alternative's land use plan concentrates most of the new development onto EPG with some increases to South Post. The Town Center Alternative's land use plan places all development on Main Post, on either side of Route 1. Thus, the effects on water resources caused by the new developments would vary to some degree by location.

Effects on water resources resulting from the BRAC action relate to the potential for increases in storm water runoff, associated physical effects, and associated pollutants from land disturbance activities. These effects would be expected to occur during construction activities and their associated land disturbance as well as for a longer term as a result of increased impervious surfaces because of development. As summarized in Table 4.7-27, the number of acres of increased high- and medium-intensity development would be greatest under the Satellite Campuses Alternative (447 acres) as compared with increases of about 348 acres under the Preferred Alternative, about 316 acres under the Town Center Alternative, and about 259 acres under the City Center Alternative. Correspondingly, the amount of land area expected to be converted from pervious to impervious surface is greatest under the Satellite Campuses Alternative (207 acres), as compared with increases of about 183 acres under the Preferred Alternative, about 142 acres under the Town Center Alternative, and about 131 acres under the City Center Alternative. Similarly, the Satellite Campuses Alternative would be expected to result in the greatest disturbance to Chesapeake Bay RPAs (40 acres) and floodplain (3 acres) as compared with 14 acres of disturbed RPAs and 3 acres disturbed floodplain under the Preferred and City Center Alternatives and 18 acres of disturbed RPAs and no disturbed floodplain under the Town Center Alternative.

Table 4.7-27
Summary of effects of BRAC implementation on water resources

Alternative	Acreage increase in high- and medium-intensity development	Acreage converted to impervious surfaces	Number of watersheds with a > 10 percent increase in total nitrogen	Number of watersheds with a > 10 percent increase in total phosphorous	Acreage of RPAs affected	Acreage of floodplains affected
Preferred	348	183	5	5	14	3
Town Center	316	142	1	1	7	0
City Center	259	131	5	5	14	3
Satellite Campuses	447	207	1	1	40	3

The greatest potential expected increases in TN and TP pollutant loading to surface waters would be expected to occur under the Preferred Alternative and the City Center Alternative, with five subwatersheds expecting to increase their loads by more than 10 percent. This compares with an expected increase of more than 10 percent in only one subwatershed under both the Town Center Alternative and the Satellite Campuses Alternative. Refer to Section 4.7.2 for a description of the methodology and assumptions used for the storm water and pollutant loading analyses.

4.8 BIOLOGICAL RESOURCES

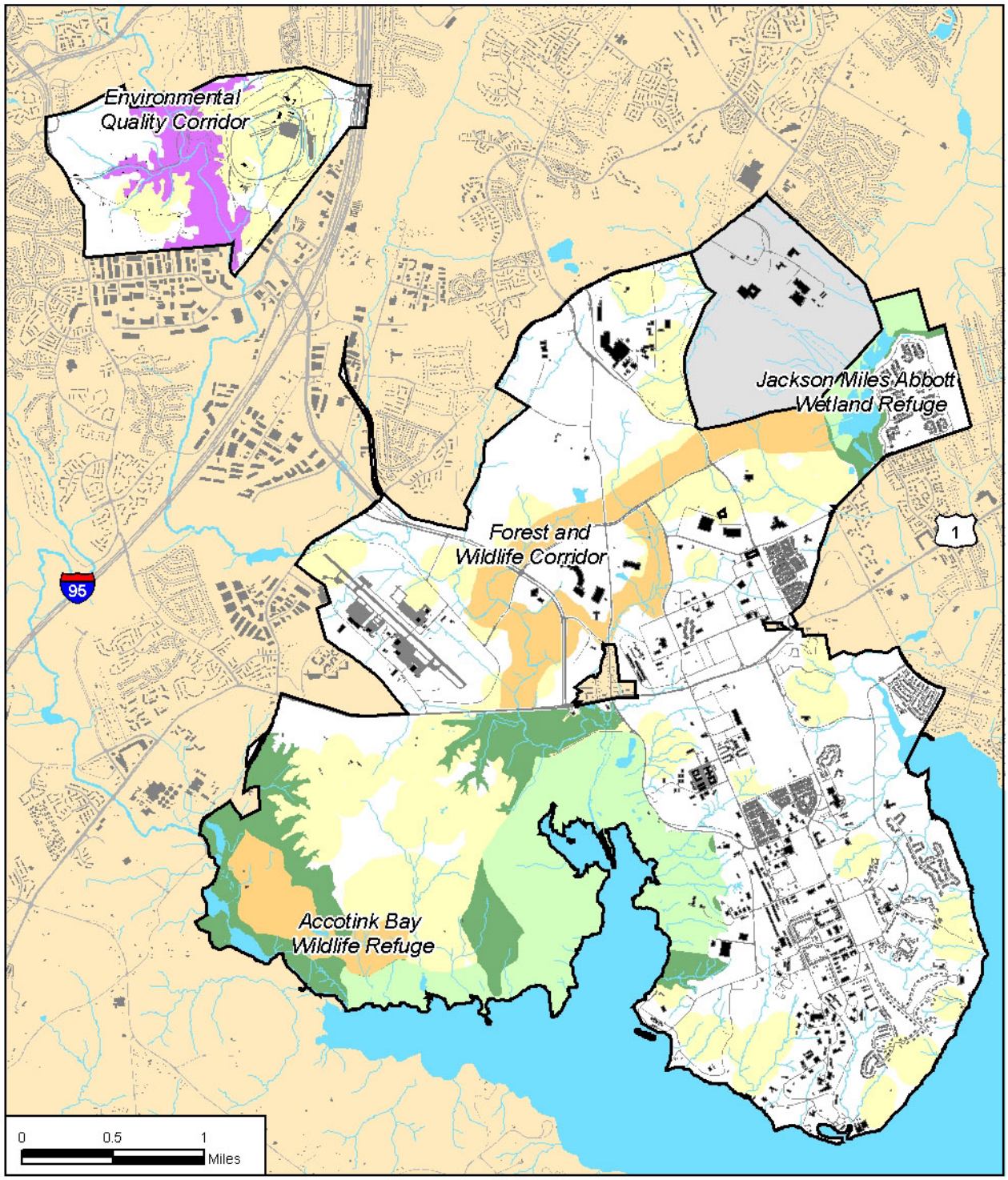
Fort Belvoir is in an ecologically complex area where three ecological subregions converge. The Outer Piedmont subregion of the Piedmont Plateau lies west of the installation, the western edge of the Coastal Plain ecoregion lies east of the installation, and the southern extent of the Upper Atlantic Coastal Plain subregion of the Eastern Broadleaf Forest (Oceanic) ecoregion lies to the north. Fort Belvoir also occupies an important location for many species of birds. The Atlantic Flyway, a major North American bird migration route, passes to the east along the Atlantic Ocean coast, and a principal migratory route from the southeastern Great Lakes region connects to the Atlantic Flyway along the Delaware River corridor. Northeast of Fort Belvoir is the Huntley Meadows Park, which is adjacent to the Jackson Miles Abbott Wetland Refuge (JMAWR) on Fort Belvoir (Figure 4.8-1). The Accotink Bay Wildlife Refuge (ABWR) borders Accotink Bay on the Southwest Area and South Post of the installation. The ABWR contains foraging habitat for the state-threatened American peregrine falcon (*Falco peregrinus anatum*), the federally threatened bald eagle (*Haliaeetus leucocephalus*), habitat for the state-threatened North American wood turtle (*Clemmys insculpta*), and Partners in Flight (PIF) priority bird species habitat. Huntley Meadows Park also has a population of wood turtles. A Forest and Wildlife Corridor extends from the installation's boundary with the Huntley Meadows Park to the installation's Southwest Area. The corridor provides a connection between the two refuges. Together, the JMAWR, the ABWR, and the Forest and Wildlife Corridor are Fort Belvoir's three designated *Special Natural Areas* (SNA), all of which are protected from development so that the ecological integrity of the areas is maintained.

EPG also has habitat for PIF species, and it is the only location in Fairfax County where the federally and state-listed species, the small whorled pogonia (*Isotria medeoloides*) has been found. On EPG, Fairfax County's Comprehensive Plan recommends for preserving and protecting the Accotink Creek Environmental Quality Corridor (EQC) from development. The *Environmental Quality Corridor System*, as defined by the Fairfax County Comprehensive Plan, is an open space system designed to link and preserve natural resource areas and provide passive recreation. The core of the EQC is the county's stream valleys, but the EQC also includes the following:

- 100-year floodplains
- Areas of 15 percent or greater slope adjacent to the floodplain (or, if no floodplain is present, 15 percent or greater slopes beginning within 50 feet of the stream channel)
- Wetlands connected to the stream valleys

EQC protection and enhancement is not a regulation but a policy that is triggered when the county has a development review (though federal projects do not go through development review).

As a consequence, management of the biological resources of Fort Belvoir requires consideration of migrating birds, threatened and endangered species, rare species and habitats, and both terrestrial and aquatic species and habitats. This section provides descriptions of the biological resources of the installation that are pertinent to the proposed action analyzed in this EIS. The 2001 Fort Belvoir INRMP (Horne, 2001) contains detailed descriptions and information about the biological resources of Fort Belvoir, and it is incorporated by reference into this EIS.



LEGEND

- Installation Property
- Wildlife Refuge
- Wildlife Management Area
- Environmental Quality Corridor
- Forest and Wildlife Corridor
- PIF Priority Bird Habitat

Sensitive Environmental Areas

Fort Belvoir, Virginia

Sources: Fort Belvoir GIS, 2006; Fairfax County GIS, 2006.

Figure 4.8-1

4.8.1 AFFECTED ENVIRONMENT

4.8.1.1 Plant Communities

Main Post. Sixteen native plant community types have been identified on the undeveloped parts of Fort Belvoir's Main Post. Table 4.8-1 lists the plant communities in order of their abundance and provides information about the general distribution of the community types. Land cover on the Main Post is shown in Figure 4.2-2. The most abundant plant *community type* on the installation is urban land. Three types of hardwood forest, each with nearly 1,000 acres or more, are the most abundant natural plant communities. Some of the communities, such as the Oak/Ericad Forest, occur as relatively large, contiguous areas, while others occur as smaller areas intermixed with other community types. A few plant communities have been planted (loblolly pine, white pine), while the majority occur according to natural constraints of soil type, topography, and moisture. The intermixing of habitats is an important natural aspect that is partially responsible for the richness of the biotic resources that occur on the installation.

Table 4.8-1
Plant communities of Fort Belvoir

Plant community	Acreage		Distribution
	Main Post	EPG	
Urban land	2,809	121	All developed areas, including improved and semi-improved grounds
Oak/Ericad (Heath family) forest	1,253	227	Upland areas of gravelly ridges and dry slopes
Beech mixed oak forest	1,146	12	Upland areas of gradual, well-drained ravine slopes
Tulip poplar mixed hardwood forest	987	75	Moist, fertile ravine slopes and ravine bottoms
Virginia pine forests	425	185	Previously-disturbed areas in mid-succession
Poorly drained floodplain hardwood forest	422	13	Somewhat poorly drained to very poorly drained floodplain bottomlands and sloughs
Loblolly pine forest	245	11	Planted stands
Old field grassland	233	53	Previously disturbed areas in early successional stages
Mixed pine hardwood forest	196	49	Previously disturbed areas in late succession
Moderately well-drained floodplain hardwood forest	173	40	Moderately well-drained to somewhat poorly-drained floodplain bottomland
Nontidal marsh/beaver pond	131	3	Above tidal limits of Accotink, Pohick, and Dogue Creeks
Tidal marsh	96	0	Shallow tidal areas of Accotink and Pohick Creeks and at the mouths of several small streams
Freshwater tidal swamp forest	45	0	Tidally influenced palustrine areas
Seep forest	39	1	Groundwater-saturated flats and slopes
Tidal scrub/shrub wetland	16	0	Edges of tidal swamp forests near the transition to tidal marsh
White pine forest	6	0	Planted stands

Source: Horne, 2001.

EPG. Table 4.8-1 lists the acreages of plant communities at EPG. A vegetation survey of EPG conducted in 1999 identified 12 plant community types on EPG (Paciulli, Simmons and Associates, Ltd., 1999). Oak forests, the most common plant community type on EPG, occur primarily on the steep slopes abutting Accotink Creek and its tributaries. Beech-mixed-oak forest occurs on gradual ravine slopes adjoining Accotink Creek, and tulip poplar-mixed-hardwood forest is found on moist fertile ravine slopes and in ravine bottoms; substantial areas of tulip poplar-mixed-hardwood forest occur in the western and southern areas of EPG. Most land near the outer perimeter of Heller Loop and on the former airstrip north of the loop supports dense, nearly pure stands of Virginia pine saplings. Mixed stands of Virginia Pine and upland hardwoods occupy areas outside the Heller Loop and in the western part of EPG. Most old field grassland is on the former training ranges in the western part of EPG, but some open areas in Heller Loop still support grassland that has not yet been encroached upon by Virginia pine. Floodplain hardwood forest occurs primarily in narrow strips of low land separating the banks of Accotink Creek from the toe of steep slopes to the east and west in the central part of EPG.

GSA Parcel. The GSA Parcel is nearly entirely developed except for the occasional landscaping features.

4.8.1.2 Wetlands

Main Post. Baseline wetland inventories have identified approximately 1,245 acres of wetlands on Fort Belvoir's Main Post, which is approximately 12 percent of the land area (Table 4.8-2). The predominant wetland type on Fort Belvoir is palustrine forested, which tends to occur in association with the riparian areas of Accotink, Dogue, and Pohick Creeks. Wetlands generally occur along permanent and intermittent streams, which are drainages of these creeks.

EPG. EPG supports approximately 26 acres of wetlands. Table 4.8-2 lists the acreages of wetlands at EPG. As on the Main Post, wetlands on EPG generally occur along permanent and intermittent streams associated with Accotink Creek. EPG wetlands provide for flood flow alteration, sediment and shoreline stabilization, wildlife habitat, recreational opportunities. The preservation of adjoining forested slopes and stream channels are important to the continuation of these wetland functions.

GSA Parcel. No wetlands are present on the GSA Parcel.

Table 4.8-2
Wetlands of Fort Belvoir

Wetland type	Main Post acreage	EPG acreage
Palustrine emergent	141.9	0.8
Palustrine forested	855.6	13.5
Palustrine open water	31.9	0.2
Palustrine scrub-shrub	0.1	6.0
Riverine tidal	165.4	0.0
Riverine, lower perennial, open water, permanent-tidal	23.7	5.3
Riverine emergent, permanently flooded	26.5	0.0

Source: Horne, 2001.

4.8.1.3 Rare Plant Communities

Main Post. A recent ecological communities assessment identified 17 community types on Fort Belvoir Main Post. Four of the communities are ranked *very rare* or *extremely rare*, and three are ranked as *rare to uncommon*. The rare communities are listed below.

- Tidal Freshwater Marsh: Spikerush—Golden-club: extremely rare
- Tidal Freshwater Marsh—Mixed: extremely rare
- Coastal Plain/Piedmont Acidic Seepage Swamp: very rare
- Tidal Shrub Swamp: very rare
- Tidal Freshwater Marsh—Wild Rice-Smartweed: rare to uncommon
- Tidal Freshwater Marsh—Mud Flat: rare to uncommon
- Tidal Hardwood Swamp: rare to uncommon

The most significant threat to the communities arises from invasive and exotic species. Wetlands are also vulnerable to storm water-related problems (e.g., sedimentation), which could be exacerbated by development near watercourses when adequate mitigation is not used.

EPG. An ecological communities survey performed on EPG did not identify any of the communities listed above, primarily because EPG is outside the tidal zone (Tetra Tech, 2006a). Rare or protected species supported on EPG are presented in Section 4.8.1.5).

GSA Parcel. No rare plant communities are known to exist on the GSA Parcel.

4.8.1.4 Animals

4.8.1.4.1 Mammals

Main Post. A series of baseline small mammal field surveys that covered representative areas of all habitat types on-post was conducted from 1987 through 1994. Mammal surveys have given the installation a good idea of the mammal species on the installation. The surveys provided general information regarding the abundance and habitat usage of each species on-post, but not population levels and trends. Forty-three species—those typical of what would be expected for the habitat mix and abundance of the installation—have been identified as occurring or potentially occurring on Fort Belvoir. Within the mix of species are those that could be found in a variety of habitats (e.g., the northern short-tailed shrew [*Blarina brevicauda*]), and those that prefer habitat types that the installation provides (e.g., the woodland vole [*Microtus pinetorum*] in undisturbed mature forest and the meadow vole [*Microtus pennsylvanicus*] of grassy old fields).

Some mammal species present management concerns. Beaver (*Castor canadensis*) can significantly alter habitat conditions through tree removal and dam building, and their impoundments can be responsible for the presence of extensive areas of palustrine wetland along Dogue Creek and within drainages to Accotink and Pohick Creeks. The river otter (*Lutra canadensis*) is a state species of concern and a management concern because of habitat loss and water pollution, which are the major threats to the species' survival. River otter have not been seen frequently on Fort Belvoir, though there is some evidence that their abundance is increasing along Fort Belvoir waterways. White-tailed deer (*Odocoilus virginiana*) is the installation's largest mammal and it is found throughout the installation in nearly all habitats. The population is dense, which is of concern to management because of the potential for disease in the herd, habitat loss through overbrowsing, and the increased chance of collisions with vehicles.

EPG. A wildlife survey was conducted on EPG in 2006. Mammals at EPG were described as consisting predominantly of white-tailed deer, Virginia opossums (*Didelphis marsupialis*), and gray squirrels (*Sciurus carolinensis*) (Tetra Tech, 2006b; USATHAMA, 1990). The brushy, open areas surrounding the abandoned Heller Loop buildings might have recently provided habitat for grassland species, but establishment and growth of Virginia pine trees has converted much of this area to habitat for mammal species favoring old fields such as eastern cottontails (*Sylvilagus floridanus*), field mice (*Peromyscus* sp.), opossums, and groundhogs (*Marmota monax*). Acorns from the dominant oaks in hardwood and mixed-hardwood forests provide a food source for mammals such as gray squirrels, whose diets depend on mast (heavy nutlike seeds).

4.8.1.4.2 Birds

Main Post. The surveys conducted on the installation have identified 275 bird species including resident, temperate migrant, and neotropical migrants. Ninety-nine species are common or abundant on the installation during the seasons when they occur on-post, indicating that the mix of habitats on the installation and the extensive areas of natural habitat provide suitable habitat for many bird species. Habitat features on Fort Belvoir that support so many bird species include the large, contiguous areas of undeveloped land; the variety of ecological communities; and abundance of food sources (e.g., insects, seeds, berries, aquatic invertebrates).

Bird species of management concern include those considered by the VDCR-NHP to be rare in Virginia and the PIF priority species for conservation that exist on Fort Belvoir. Fort Belvoir's ENRD intends to actively preserve and enhance habitat for some of these species, and it is in the process of preparing a Bird Conservation Plan for the installation. The PIF program is discussed above. High-priority PIF species that have been known to breed on Fort Belvoir include the American black duck (*Anas rubripes*), American woodcock (*Philohela minor*), whip-poor-will (*Caprimulgus vociferus*), yellow-throated vireo (*Vireo flavifrons*), wood thrush (*Hylocichla mustelina*), hooded warbler (*Wilsonia citrina*), prairie warbler (*Dendroica discolor*), worm-eating warbler (*Helmitheros vermivorus*), prothonotary warbler (*Protonotaria citrea*), Kentucky warbler (*Opororins formosus*), scarlet tanager (*Piranga olivacea*), and field sparrow (*Spizella pusilla*).

The brown-headed cowbird (*Molothrus ater*) is a nest parasite that poses a significant threat to nesting migrants, including several of the PIF priority species breeding on Fort Belvoir. It occurs throughout the installation and extends into all forest tracts on-post. Cowbirds benefit from habitat fragmentation. Installation bird surveys have recommended minimizing fragmentation to control cowbird intrusion into the installation's forest tracts and to protect vulnerable migratory bird species from nest predation.

EPG. The Fairfax Audubon Society reported numerous bird species in forested land in Wakefield Park, on Accotink Creek upstream of EPG, in 1998 and 1999, including many species of warbler, Philadelphia vireo (*Vireo philadelphicus*), black-billed cuckoo (*Coccyzus erythropthalmus*), Lincoln's sparrow (*Melospiza lincolnii*), sedge wren (*Cistothorus platensis*), sora (*Porzana carolina*), red-headed woodpecker (*Melanerpes erythrocephalus*), and bald eagle (*Haliaeetus leucocephalus*) (Collins, 2000). The forest clearings associated with former training ranges west of Accotink Creek appear to provide good habitat for bird species favoring grassland and old field habitats such as the prairie warbler and field sparrow. The oak-heath forest and other mature upland forests on the slopes adjoining Accotink Creek probably provide good habitat for bird species favoring forest interior habitat such as cerulean warblers (*Dendroica cerulea*), American redstarts (*Setophaga ruticilla*), hooded warblers, red-eyed vireos (*Vireo olivaceus*), ovenbirds (*Seiurus aurocapillus*), wood thrushes, scarlet tanagers, and pileated woodpeckers

(*Dryocopus pileatus*). Establishment and growth of Virginia pine seedlings has converted much of the brushy, open areas surrounding Heller Loop buildings to habitat for species favoring old fields such as mourning doves (*Zenaida macroura*), northern mockingbirds (*Mimus polyglottos*), American robins (*Turdus migratorius*), and brown thrashers (*Toxostoma rufum*). The dense Virginia pine saplings around the perimeter of Heller Loop and other scattered locations on EPG might provide some of the best habitat in the region for species favoring coniferous forests, such as Carolina wrens (*Thryothorus ludovicianus*), red-breasted nuthatches (*Sitta canadensis*), prairie warblers, and field sparrows.

4.8.1.4.3 Reptiles

Main Post. Numerous field surveys of reptile species have been conducted on Fort Belvoir, providing data on those species that either occur or are potentially occurring on the installation, although not on their individual abundances or distributions. Thirty-two species of reptiles have been identified as occurring or likely to occur on Fort Belvoir, including 10 species of turtle, 18 species of snake, and 4 species of lizard. All the species are typical of the northern Virginia, upper-Coastal Plain, although several are at the limits of their ranges (e.g., the North American wood turtle, more on which is given in Section 4.8.1.5.1). The 10 species of turtles occur in association with shallow, slow-moving waters with mud bottoms. The most common turtle on-post is the snapping turtle (*Chelydra serpentina*). The snake species occur in all habitat types at Fort Belvoir, including aquatic species such as the northern water snake (*Nerodia sipedon*). The only venomous snake endemic to Fort Belvoir is the copperhead (*Agkistrodon contortix*), which occurs in moist deciduous/mixed woods. Three of the four lizard species occur in mesic, deciduous, or deciduous/mixed woods; the fourth occupies dry, open areas.

EPG. The upland and wetland habitats on EPG provide good habitat for many reptile species. The former ranges and the old-field habitat provide good habitat for snakes common to brushy upland areas such as eastern garter snakes (*Thamnophis sirtalis*), and black racers (*Coluber constrictor constrictor*), and for turtles common to upland areas, such as the eastern box turtle (*Terrapene carolina carolina*). The dry, rocky slopes adjoining Accotink Creek and the remains of abandoned buildings might provide habitat for copperheads.

4.8.1.4.4 Amphibians

Main Post. Twenty-seven amphibian species have been identified as occurring or potentially occurring on Fort Belvoir, including 11 species of frog, 3 species of toad, and 13 species of salamander. They are all typical of the northern Virginia, upper-Coastal Plain, and several are at the limits of their range. The varied aquatic and terrestrial habitats on the installation, including the wetland areas, wooded drainage areas, and ephemeral ponds, provide extensive areas of suitable amphibian habitat. Development, loss of cover, loss of surface waters, habitat fragmentation, and disruption of natural travel corridors are threats to the amphibian populations on the installation.

EPG. The small and narrow areas of wetlands on EPG adjoining Accotink Creek and its tributaries provide favorable habitat for amphibians such as spring peepers (*Pseudacris crucifer*), chorus frogs (*Pseudacris* sp.), American toads (*Bufo americanus*), Fowler's toads (*Bufo woodhousii fowleri*), and bullfrogs (*Rana catesbeiana*). The EPG wetlands are surrounded by undeveloped forested uplands, making them better amphibian habitat than wetlands outside EPG that lie in close proximity to developed areas.

4.8.1.5 Rare, Threatened, and Endangered Species

Main Post. Fort Belvoir supports habitat for the federally listed bald eagle and small whorled pogonia. Additionally, inventories conducted by VDCR-NHP identified seven Virginia state rare animal species and four Virginia state rare plant species on the installation. The inventory also identified 16 state watchlist animal species and 3 state watchlist plant species on Fort Belvoir. Each of these species was documented as occurring in aquatic or wetland habitats on Fort Belvoir. Numerous other species of birds, mammals, reptiles, and amphibians that have been documented as occurring on the installation and that have been designated as a Virginia state-rare species with a state rarity rank of S1 (critically imperiled), S2 (imperiled), or S3 (vulnerable). Figure 4.8-2 depicts the locations of habitats on Fort Belvoir. A complete listing of rare species can be found in the Fort Belvoir INRMP. Fort Belvoir's location at the intersection of three ecoregion subtypes and the variety of habitats that its location, topography, and water resources provide, as well as the protection afforded to the land by the military presence in an otherwise rapidly-developing area, make it possible for these species to exist on the installation.

EPG. The inventories mentioned above include EPG. Only two rare or protected species are considered to occur or potentially occur on EPG. Details are provided below.

GSA Parcel. No rare or protected species are known to exist on the GSA Parcel.

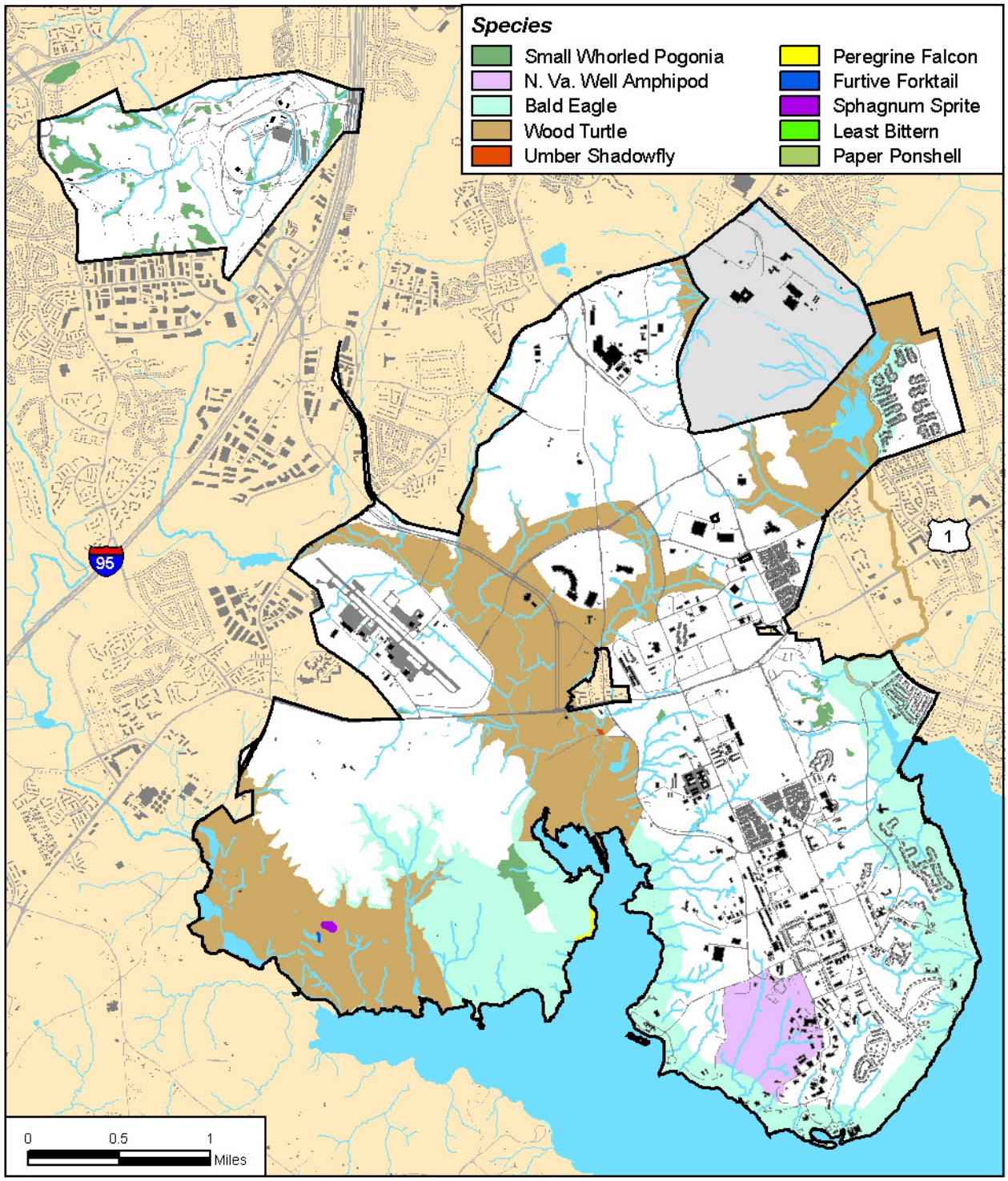
4.8.1.5.1 Wood Turtle

Main Post. The North American wood turtle, a state-listed threatened species, has been observed at Fort Belvoir at various locations along the Dogue Creek and Accotink Creek drainages, which indicates an on-post population and that the wooded streams of the installation provide habitat for the species. The species occurs in a relatively small area of eastern Canada and the northeastern United States. Its geographic range extends from Nova Scotia and New Brunswick south to northern Virginia and west to eastern Minnesota. At Fort Belvoir, the species is near the southeastern extent of its range. Within its range, the turtle is generally uncommon to rare (Harding, 2002). Wood turtles are generally found near moving water, though they would use areas at considerable distances from water, and in some places they appear to use riparian woods, shrub or berry thickets, swamps, and open, grassy areas. Some unvegetated or sparsely vegetated patches are needed for nesting. The turtles use stream valleys as dispersal corridors. Wood turtles are a conservation concern because their populations have been depleted from collecting for the pet trade and habitat destruction. A naturally low reproductive rate and continued habitat loss keep turtle populations from recovering.

EPG. An installation-wide field survey for wood turtles was performed for Fort Belvoir, including EPG, from April to June in 2002 (Paciulli, Simmons, and Associates, Ltd., and Mitchell Ecological Research, LLC, 2002). The survey included 8 days of visual encounter survey work and 46 days of turtle trapping activities along Accotink Creek, including the reach crossing EPG. No wood turtles were found. The survey noted that some areas on Accotink Creek within EPG possess physical characteristics similar to suitable wood turtle habitat in more rural settings, but it concluded that those areas are not optimal wood turtle habitat because of the narrow floodplain, presence of exotic riparian vegetation, and runoff from dense, upstream development.

4.8.1.5.2 Bald Eagle

Main Post. The bald eagle is listed federally and in Virginia as threatened. Fort Belvoir has active nests and designated bald eagle habitat and nest buffer areas on the southeastern part of the



LEGEND

Installation Property

Rare, Threatened or Endangered Species Habitat

Fort Belvoir, Virginia

Sources: Fort Belvoir GIS, 2006; Fairfax County GIS, 2006.

Figure 4.8-2

Southwest Area and along Dogue Creek on the South Post. Bald eagles require nest trees, roosts, and feeding grounds. The installation shoreline along Pohick Creek, Pohick Bay, Accotink Bay, Accotink Creek, Gunston Cove, the Potomac River, and Dogue Creek is designated as foraging and resting habitat for the birds and is used year-round by bald eagles. Bald eagles also forage in the JMAWR. The shoreline extending from Pohick Creek and around Accotink Creek within the ABWR is a high-use foraging area where eagle activity is concentrated in the winter. Bald eagles feed primarily on fish, though they would also take small mammals, seabirds, and waterfowl, and they are opportunistic in that they would steal the prey of other animals (Harris, 2002).

EPG. As noted above, the Fairfax Audubon Society reported sighting bald eagles in forested land on Accotink Creek upstream of EPG. The creek can provide habitat for bald eagles where it passes through EPG. Bald eagles historically nested on EPG in the Accotink Creek riparian corridor.

4.8.1.5.3 American Peregrine Falcon

Main Post. The American peregrine falcon is a state-listed threatened species that also occurs seasonally at Fort Belvoir but is not considered a resident species. Falcons forage along the Accotink Creek/Accotink Bay stream corridor and JMAWR during fall migration.

EPG. The peregrine falcon has been recorded on Fort Belvoir during migration, when the birds take advantage of foraging habitat along the Accotink Creek corridor (U.S. Army, 2001). The Accotink Creek corridor crosses the central part of EPG, and the species can occur transiently on EPG, especially in trees on the forested slopes.

4.8.1.5.4 Small Whorled Pogonia

Main Post. The small whorled pogonia, a perennial terrestrial orchid, is a federally listed threatened species and Virginia state-listed endangered species. Although it has not been recorded on the Main Post, the U.S. Fish and Wildlife Service (USFWS) considers the installation to possess potential habitat for this species. The species is generally known from open, dry, deciduous woods with acid soil (USFWS, 1996). Surveys for the species have been conducted on Fort Belvoir, including on the proposed sites for the new hospital, the PX expansion, the INSCOM Information Dominance Center, and the DCEETA T-Block on the North Post (Bedker, 2005).

EPG. The small whorled pogonia was observed in the summer of 2005 on steep, oak-dominated forested slopes on a first order tributary of Accotink Creek in the southwestern part of EPG. EPG is the only location in Fairfax County where the species has been found. Areas of EPG that have been rated as high-, medium-, and low-quality habitat for the small whorled pogonia are along the western and southern boundaries of EPG. The plant is herbaceous and orchid-like and typically occurs in oak-dominated upland hardwood forests with a relatively open understory and sparse groundcover or in shaded openings in mixed hardwood-pine woods (WSSI, 2005; 2006).

4.8.1.5.5 Northern Virginia Well Amphipod

Main Post. The northern Virginia well amphipod (*Stygobromus phreaticus*) is a federal *species of concern*, is under consideration by the USFWS for listing under the ESA, and is listed by Virginia as *extremely rare*; it is considered to be globally rare. It is a shrimp-like crustacean that lives in groundwater. It has been found in T-17 training area ravine seeps on the South Post (VDGIF, 2002), and the T-17 training area is the only location where the species has been

documented to occur (Culver, personal communication, 2007; Hobson, personal communication, 2007).

EPG. The northern Virginia well amphipod is not known to occur on EPG. Seep habitat suitable to the species occurs on EPG in the Accotink Creek riparian corridor, and specimens of the genus *Stygobromus* have been found in the seeps.

4.8.1.5.6 Shortnose Sturgeon

Main Post. The only fish identified in the Fort Belvoir region that has federal or state threatened or endangered designation is the federally endangered shortnose sturgeon (*Acipenser brevirostrum*), which has been documented in the Potomac River in recent years (FHWA, 2003). According to the National Marine Fisheries Service (NMFS), the farthest north on the Potomac River that the shortnose sturgeon has been sighted is approximately 25 miles south of the installation (Mangold, 2005). Between 1998 and 2004, seven shortnose sturgeon were captured in the Potomac River as a result of the USFWS Atlantic Sturgeon Reward Program (FHWA, 2003; Mangold, 2005), and a prespawning female was captured at Craney Island in September 2005. While sturgeon populations were abundant and stable in the past, overfishing depleted local stocks in the late 19th century, and the remnant population in the Chesapeake Bay estuary is small (Secor, 2002). NMFS developed a Fisheries recovery plan in 1998 indicating that shortnose sturgeon found in the Chesapeake Bay and its tributaries (including the Potomac River) are considered part of the Chesapeake Bay distinct population segment. A Fisheries Recovery Plan aims to restore the species to its historic range in the Potomac River.

EPG. EPG does not support habitat for the shortnose sturgeon.

4.8.2 ENVIRONMENTAL CONSEQUENCES OF THE PREFERRED ALTERNATIVE

4.8.2.1 Vegetation

4.8.2.1.1 Land Use Plan Update

All areas designated as Environmentally Sensitive or Outdoor Recreation under the 1993 land use plan—the land use areas of most concern to natural resource management—would be redesignated under the Preferred Alternative, as listed in Table 4.8-3. Note, however, that the three SNAs on the Main Post (the JMAWR, the ABWR, and the Forest and Wildlife Corridor) are protected from development regardless of their land use designation in the Fort Belvoir Master Plan.

Long-term moderate adverse effects would be expected. While changes in land use designation alone would not have consequences for vegetation, areas previously designated as Environmentally Sensitive or Outdoor Recreation could potentially be used for purposes incompatible with natural resources management goals under the new land use designations. For instance, the Community land use designation under the Preferred Alternative land use plan is the land use designation for outdoor recreation areas and buffer areas, but the Community land use designation also includes use for retail stores, libraries, PX, clubs, and town centers. Areas designated Outdoor Recreation or Environmentally Sensitive under the 1993 land use plan (except for the SNAs), if changed to Community, might remain as outdoor recreation areas or environmentally protected buffer areas but could be used for purposes less protective of natural vegetation. Other land use designation changes from the 1993 land use plan to the Preferred

Alternative land use plan that could create vegetation management issues similar to the above example are discussed below.

- *Environmentally Sensitive redesignated as Range/Training*. Range/Training land use includes use of land for ranges, maneuver areas, and vehicle maneuver areas. While areas designated as Environmentally Sensitive in the land use plan have always been operational training areas or closed training areas, the redesignation as Range/Training could be less protective of natural vegetation than a specific Environmentally Sensitive land use designation.
- *Environmentally Sensitive or Outdoor Recreation redesignated as Professional/ Institutional or Residential*. Professional/Institutional and Residential land use designations support development. Development could be designed to protect natural vegetation, but some vegetation clearing and effects to vegetative community functioning would result from any development in a previously undeveloped area. Development in an environmentally sensitive area would be expected to have a level of adverse consequence on vegetation.
- *Environmentally Sensitive or Outdoor Recreation redesignated as Airfield*. This land use designation change would probably be of the least concern on Fort Belvoir. Areas surrounding Davison Army Airfield that are currently designated as Environmentally Sensitive and Outdoor Recreation serve as safety and noise buffer areas between other land use areas and the airfield where constraints on development would still be necessary. It would be anticipated that these buffer areas would continue to be necessary and protected under the Preferred Alternative land use plan.

Table 4.8-3
Environmentally sensitive and outdoor recreation land use designation changes under the Preferred Alternative land use plan

General area of Post	1993 land use designations and Preferred Alternative land use designations	
	1993 Land Use designation changed to:	1993 outdoor recreation, land use designation changed to:
EPG	n/a	n/a
Davison Army Airfield (West of Fairfax County Parkway)	Airfield	Airfield
Central and Western Southwest area	Training	n/a
Eastern Southwest area (bordering Accotink Creek)	Community	n/a
Fort Belvoir North Post Golf Course (north of Kingman Road and west of HEC)	Community	Community
Northeast North Post and North Post areas near Route 1	Professional/Institutional, Community, Training, Residential	Professional/Institutional, Community
South Post bordering Accotink Bay	Professional/Institutional, Community	Community
South Post golf course	n/a	Professional/Institutional, Community
South Post Eastern and Southern areas	n/a	Community, Residential

Changes in the land use designation of areas adjoining Environmentally Sensitive and Outdoor Recreation areas would not have an effect on vegetation. Areas with all other land use designations under the 1993 land use plan currently adjoin Environmentally Sensitive and Outdoor Recreation areas and are therefore subject to development. The situation would not change under the Preferred Alternative land use plan.

4.8.2.1.2 BRAC Implementation and Facilities Projects

Long-term moderate adverse effects would be expected. Areas of the Main Post that would be disturbed by the construction are largely in previously developed areas and not within areas specifically managed for natural resources conservation, such as the Forest and Wildlife Corridor. Most of the area proposed for development on EPG under the Preferred Alternative is also previously disturbed. Table 4.8-4 identifies the types of vegetative communities that would be disturbed under the Preferred Alternative and the total area of projects proposed for different areas of the Post. The hardwood and mixed pine-hardwood stands are more representative of the natural vegetation of the region. This type of vegetation is found in areas proposed for development on EPG that are nearest to the EQC and the eastern boundary of EPG and on the Main Post at the southern end of the South Post area. Loss of the vegetation would reduce the amount of hardwood and mixed forest on the installation but would not substantially reduce the amount of the vegetative community types.

Nevertheless, the large amount of development associated with the Preferred Alternative would require the conversion of much vegetated area on the Main Post and EPG to developed areas, would increase habitat fragmentation and reduce habitat connectivity, would be expected to increase the occurrence of invasive species in fragmented habitats, and could reduce the overall ecological integrity of the installation's natural habitats. Implementation of BRAC at Fort Belvoir would further reduce the quantities of a variety of vegetative communities in a region that has already lost a large quantity of its natural landscape.

Table 4.8-4
Vegetative community types potentially impacted by projects proposed under the Preferred Alternative

Area of Post	Vegetative community types potentially affected	Total approximate acres of projects proposed in area
EPG	Virginia pine, old field, hardwood, mixed pine-hardwood	108
North Post	Hardwood	11
South Post–golf course	White pine, hardwood, loblolly pine	28
South Post–other areas	Hardwood	17

4.8.2.2 Wildlife

4.8.2.2.1 Land Use Plan Update

Long-term minor adverse effects would be expected. Impacts of the land use plan update on wildlife would generally be similar to those on vegetation—that is, areas previously designated as Environmentally Sensitive or Outdoor Recreation (except the SNAs) could potentially be used for purposes incompatible with natural resources management goals under the new land use

designations. Protection of the most important wildlife areas on the Main Post, however—the three SNAs on Fort Belvoir—and the limited amount of development in the Southwest Area and shoreline zones of the South Post, would be expected to limit the impact of land use designation changes on wildlife species.

4.8.2.2.2 BRAC Implementation and Facilities Projects

Long-term moderate adverse effects would be expected. Effects on wildlife species—not including endangered, threatened, or sensitive species (which are discussed below)—of the implementation of BRAC projects would largely parallel changes to natural vegetation. Loss of natural vegetation would impact wildlife as a loss of habitat and the potential negative consequences of BRAC implementation on vegetative communities (i.e., fragmentation, loss of connectivity, increases of invasive species) would also adversely affect wildlife species. Restricted wildlife movements between areas that provide different life-history necessities can limit a population's viability, and isolated populations of a species can suffer from reduced genetic interchange. Projects proposed under the Preferred Alternative would not directly affect critical wildlife management areas such as the Forest and Wildlife Corridor and areas bordering Accotink Bay. The most important effects of BRAC development on wildlife, therefore, would predominantly be the impacts from losses of habitat on the eastern half of EPG and the southern extent of the South Post.

4.8.2.3 Endangered, Threatened, and Sensitive Species

4.8.2.3.1 Land Use Plan Update

Long-term minor adverse effects would be expected. A change in land use designation from Environmentally Sensitive or Outdoor Recreation to any land use designation under the Preferred Alternative land use plan could have adverse consequences for protected or sensitive species. Other land use designation changes under the Preferred Alternative land use plan would not be expected to affect sensitive or protected species because development is already a potential on land designated as anything other than Environmentally Sensitive. No effects on sensitive or protected species from a change in land use designation would occur on EPG because all areas of EPG are available for some type of development under both the 1993 land use plan and the Preferred Alternative land use plan.

4.8.2.3.2 BRAC Implementation and Facilities Projects

Long-term moderate adverse effects would be expected. Projects proposed under the Preferred Alternative could have an impact on fauna and flora special species areas on EPG and on fauna special species areas on the South Post. Projects proposed on EPG could reduce the quantity of habitat for the following PIF species: field sparrow, prairie warbler, wood thrush, and worm-eating warbler. A total of 179 acres of PIF habitat, 8 acres of sensitive flora habitat, and 6 acres of sensitive fauna habitat would be lost under the alternative. Additionally, the small whorled pogonia has been found on the western portion of EPG and it is the only known location of the species in Fairfax County (WSSI, 2005). The west EPG parcel has numerous areas rated as medium- and high-quality small whorled pogonia habitat and could harbor the species in a dormant state in the soil or serve as an expansion area for the species' recovery. Small whorled pogonias can remain dormant for several years in the soil between aboveground appearances of the plant (WSSI, 2006). A project for the South Post, a family travel camp, is proposed for areas identified as *occasional-use foraging areas* for bald eagles. This occasional-use foraging area extends from the mouth of Accotink Bay to Dogue Creek. Additionally, the family travel camp

would be constructed in an area designated as habitat for the worm-eating warbler, a PIF species. The family travel camp project area is also an area where seeps of the type that support the northern Virginia well amphipod occur, and indirect impacts on that species could occur from development. Finally, road improvement projects pass through wood turtle habitat.

4.8.2.4 Sensitive Natural Areas

4.8.2.4.1 Land Use Plan Update

Long-term moderate adverse effects would be expected. Sensitive natural areas on Fort Belvoir include the three SNAs, grassland management areas, wetlands, riparian buffers, and the EQC on EPG. Under the 1993 land use plan, these areas occur under several land use designations. As with vegetation, wildlife, and protected and sensitive species, only sensitive natural areas (other than the three SNAs) that occur on land designated as Environmentally Sensitive or Outdoor Recreation under the 1993 land use plan would potentially be affected under the Preferred Alternative land use plan. Adverse effects on all types of sensitive natural areas on Fort Belvoir, therefore, are possible under the Preferred Alternative land use plan.

4.8.2.4.2 BRAC Implementation and Facilities Projects

Long-term moderate adverse effects would be expected. Projects proposed for EPG are in or near the EQC and in areas with wetlands; projects proposed for the South Post could affect wetlands, riparian buffers, and RPAs; and projects in the North Post could indirectly encroach upon the Forest and Wildlife Corridor and create additional edge effect and invasive species incursions. Approximate acreages of natural resources that could be directly affected under the proposed action are 21 acres of the EQC, 2 acres of wetlands, 6 acres of riparian buffers, and 14 acres of RPAs.

4.8.2.5 BMPs/Mitigation

BMPs. Measures that the Army can consider to reduce the impacts of the Preferred Alternative on biological resources include:

- Ensure no development occurs in SNAs
- Adhere to Fort Belvoir Natural Resources management policies and goals, as specified in the INRMP
- Replace habitat lost to development with native community habitat
- Avoid construction during breeding bird nesting seasons
- Place signage identifying the EQC, SNAs, endangered and threatened species habitats and use areas, and riparian corridors in newly developed areas near these sensitive natural areas
- Use low-impact development techniques to limit the loss of natural vegetation
- Enforce no-entry zones around bald eagle nest buffers
- Identify and mark bald eagle perch trees to avoid their being removed for development
- Create through habitat manipulation new areas suitable for PIF species whose habitat areas are reduced by BRAC development

Mitigation. No specific mitigation measures are identified.

4.8.3 ENVIRONMENTAL CONSEQUENCES OF THE TOWN CENTER ALTERNATIVE

4.8.3.1 Vegetation

4.8.3.1.1 Land Use Plan Update

Long-term moderate adverse effects would be expected. The discussion in Section 4.8.2.1.1 applies equally to a change from the 1993 land use plan to the Town Center Alternative land use plan. In terms of the potential effect on vegetation, the differences between the Preferred Alternative land use plan and the Town Center Alternative land use plan are negligible. All areas designated as Environmentally Sensitive or Outdoor Recreation—the land use areas of most concern to natural resource management—under the 1993 land use plan would be redesignated under the Town Center Alternative land use plan, as listed in Table 4.8-5.

Table 4.8-5
Environmentally Sensitive and Outdoor Recreation land use designation changes under the Town Center Alternative land use plan

General area of Post	1993 land use designations and Town Center Alternative land use designations	
	1993 Environmentally Sensitive land use designation changed to:	1993 Outdoor Recreation, land use designation changed to:
EPG	n/a	n/a
Davison Army Airfield (west of Fairfax County Parkway)	Airfield, Professional/Institutional	Airfield
Central and Western Southwest area	Range/Training	n/a
Eastern Southwest area (bordering Accotink Creek)	Community	n/a
Fort Belvoir North Post Golf Course (north of Kingman Road and west of HEC)	Community	Community
Northeast North Post and North Post areas Near Route 1	Professional/Institutional, Community, Residential	Professional/Institutional, Community
South Post bordering Accotink Bay	Professional/Institutional, Community	Community
South Post golf course	n/a	Professional/Institutional, Community, Residential
South Post Eastern and Southern areas	n/a	Community, Residential

4.8.3.1.2 BRAC Implementation and Facilities Projects

Long-term moderate adverse effects would be expected. Effects on vegetation of the BRAC construction proposed under the Town Center Alternative would be similar to those for the Preferred Alternative (see Section 4.8.2.1.2). Compared to the Preferred Alternative, the Town Center Alternative would potentially result in fewer adverse effects on natural vegetation because less mixed and hardwood forest would be disturbed at the southern end of the South Post on the Main Post. Development would be concentrated on the North Post and the South Post golf course area. Table 4.8-6 identifies the types of vegetative communities that would be disturbed under the

Town Center Alternative and the total area of projects proposed for different areas of the Post. Nevertheless, the amount of development that would occur under BRAC would, as under the Preferred Alternative, convert a substantial amount of vegetated area to developed land.

Table 4.8-6
Vegetative community types potentially affected by projects proposed under the Town Center Alternative

Area of Post	Vegetative community types potentially affected	Total approximate acres of projects proposed in area
North Post	Hardwood	37
South Post–golf course	White pine, hardwood, loblolly pine	113
South Post–other areas	Hardwood	5

4.8.3.2 Wildlife

4.8.3.2.1 Land Use Plan Update

Long-term minor adverse effects would be expected. The discussion in Section 4.8.2.2.1 applies equally to a change from the 1993 land use plan to the Town Center Alternative land use plan. In terms of the potential effect on wildlife, the differences between the Preferred Alternative land use plan and Town Center Alternative land use plan are negligible.

4.8.3.2.2 BRAC Implementation and Facilities Projects

Long-term moderate adverse effects would be expected. As with the Preferred Alternative, projects proposed under the Town Center Alternative would not affect critical wildlife management areas such as the SNAs and areas bordering Accotink Bay, but the Town Center Alternative would result in the loss of more than 150 acres of pine and hardwood vegetated areas that support wildlife species. Indirect effects on wildlife such as habitat loss and fragmentation and could adversely affect some wildlife species. Most habitats directly affected under the Town Center Alternative would be in or near previously disturbed areas.

4.8.3.3 Endangered, Threatened, and Sensitive Species

4.8.3.3.1 Land Use Plan Update

Long-term minor adverse effects would be expected. The discussion in Section 4.8.2.3.1 applies equally to a change from the 1993 land use plan to the Town Center Alternative land use plan. In terms of the potential effect on protected and sensitive species, the differences between the Preferred Alternative land use plan and the Town Center Alternative land use plan are negligible.

4.8.3.3.2 BRAC Implementation and Facilities Projects

Long-term minor adverse effects would be expected. Projects proposed under the Town Center Alternative could have a minor effect on fauna special species areas on the South Post. One project proposed on the South Post, a family travel camp, is proposed for an area that is occasionally used by bald eagles for foraging and that is in an area designated as habitat for the worm-eating warbler, another PIF species. A total of 30 acres of PIF habitat, 2 acres of sensitive fauna habitat, and 2 acres of grassland management areas would be lost under the alternative. The

proposed projects would not affect the habitats of other protected or sensitive species on the South Post or any protected or sensitive species on the North Post, Southwest Area, or EPG.

4.8.3.4 Sensitive Natural Areas

4.8.3.4.1 Land Use Plan Update

Long-term minor adverse effects would be expected. The discussion in Section 4.8.2.4.1 applies equally to a change from the 1993 land use plan to the Town Center Alternative land use plan. In terms of the potential effect on sensitive natural areas, the differences between the Preferred Alternative land use plan and the Town Center Alternative land use plan are negligible.

4.8.3.4.2 BRAC Implementation and Facilities Projects

Long-term moderate adverse effects would be expected. Projects proposed for the North Post and South Post would be near wetlands, riparian buffers, and RPAs. Approximate acreages of natural resources that could be affected under the Town Center Alternative are one acre of wetlands, 11 acres of riparian buffers, and 18 acres of RPAs.

4.8.3.5 BMPs/Mitigation

The BMPs listed for the Preferred Alternative apply equally to the Town Center Alternative to reduce the adverse effects of the Town Center Alternative on biological resources.

4.8.4 ENVIRONMENTAL CONSEQUENCES OF THE CITY CENTER ALTERNATIVE

4.8.4.1 Vegetation

4.8.4.1.1 Land Use Plan Update

Long-term moderate adverse effects would be expected. The discussion in Section 4.8.2.1.1 applies equally to a change from the 1993 land use plan to the City Center Alternative land use plan. In terms of the potential effect on vegetation, the differences between the Preferred Alternative land use plan and the City Center Alternative land use plan are negligible. All areas designated as Environmentally Sensitive or Outdoor Recreation—the land use areas of most concern to natural resource management—under the 1993 land use plan would be redesignated under the City Center Alternative land use plan, as listed in Table 4.8-7.

Table 4.8-7
Environmentally Sensitive and Outdoor Recreation land use designation changes under the City Center Alternative land use plan

General area of Post	1993 land use Designations and City Center Alternative land use designations	
	1993 Environmentally Sensitive land use designation changed to:	1993 Outdoor Recreation land use designation changed to:
EPG	n/a	n/a
Davison Army Airfield (west of Fairfax County Parkway)	Airfield, Professional/Institutional	Airfield
Central and Western Southwest area	Range/Training	n/a
Eastern Southwest Area (bordering Accotink Creek)	Community	n/a
Fort Belvoir North Post golf course (north of Kingman Road and west of HEC)	Community	Community
Northeast North Post and North Post Areas Near Route 1	Professional/Institutional, Community, Residential	Professional/Institutional, Community
South Post bordering Accotink Bay	Professional/Institutional, Community	Community
South Post golf course	n/a	Professional/Institutional, Community, Residential
South Post Eastern and Southern areas	n/a	Community, Residential

4.8.4.1.2 BRAC Implementation and Facilities Projects

Long-term moderate adverse effects would be expected. Effects on vegetation of the BRAC construction proposed under the City Center Alternative would be similar to those for the Preferred Alternative (see Section 4.8.2.1.2). The following differences distinguish the two alternatives: compared to the Preferred Alternative, the City Center Alternative would result in more adverse effect on natural vegetation on EPG. The City Center Alternative concentrates development on the eastern half of EPG, which would result in more loss of hardwood and mixed forest vegetative areas than under the Preferred Alternative. The eastern half of EPG is where most previously disturbed areas are, but EPG does represent an isolated area of semi-natural and natural land in a heavily developed region, and implementing the City Center Alternative could result in the loss of a substantial amount of its natural vegetation.

Disturbance of natural vegetation on the Main Post under this alternative would be less than that under the Preferred Alternative, primarily because less vegetation would be disturbed on the South Post. The City Center Alternative in general concentrates development on previously developed and undeveloped areas on EPG and avoids the loss of naturally vegetated areas on the Main Post. Table 4.8-8 identifies the types of vegetative communities that would be disturbed under the City Center Alternative and the total area of projects proposed for different areas of the Post.

No impacts on vegetation at the GSA parcel would be expected, as the area does not support natural vegetative communities.

Table 4.8-8
Vegetative community types potentially affected by projects proposed under the City Center Alternative.

Area of Post	Vegetative community types potentially affected	Total approximate acres of projects proposed in area
EPG	Virginia pine, loblolly pine, old field, hardwood, mixed pine-hardwood	95
North Post	Hardwood	11
South Post–golf course	Hardwood	5
South Post–other areas	Hardwood	5

4.8.4.2 Wildlife

4.8.4.2.1 Land Use Plan Update

Long-term minor adverse effects would be expected. The discussion in Section 4.8.2.2.1 applies equally to a change from the 1993 land use plan to the City Center Alternative land use plan. In terms of the potential effect on wildlife, the differences between the Preferred Alternative land use plan and the City Center Alternative land use plan are negligible.

4.8.4.2.2 BRAC Implementation and Facilities Projects

Long-term moderate adverse effects would be expected. Projects proposed under the City Center Alternative would result in the loss of a substantial amount of PIF habitat on eastern EPG and could affect the habitats of the EQC, and would result in the loss of more than 110 acres of pine and hardwood vegetated areas that support wildlife species. Indirect effects on wildlife such as habitat loss and fragmentation and could adversely affect some wildlife species. Critical wildlife management areas such as the SNAs and areas bordering Accotink Bay would not be affected.

No impacts on wildlife at the GSA parcel would be expected, as the area does not support natural wildlife habitats.

4.8.4.3 Endangered, Threatened, and Sensitive Species

4.8.4.3.1 Land Use Plan Update

Long-term minor adverse effects would be expected. The discussion in Section 4.8.2.3.1 applies equally to a change from the 1993 land use plan to the City Center Alternative land use plan. In terms of the potential impact on protected and sensitive species, the differences between the Preferred Alternative land use plan and the City Center Alternative land use plan are negligible.

4.8.4.3.2 BRAC Implementation and Facilities Projects

Long-term moderate adverse effects would be expected. Projects proposed under the City Center Alternative could affect fauna special species areas on EPG and the South Post. Projects proposed on EPG would affect the habitats of the following PIF species: field sparrow, prairie warbler, wood thrush, and worm-eating warbler. A project proposed on the South Post, a family travel camp, is proposed for an area occasionally used by bald eagles for foraging and that is designated as habitat for the worm-eating warbler, another PIF species. The family travel camp project area is also an area where seeps of the type that support the northern Virginia well amphipod occur,

and indirect impacts on that species could occur from development. Of all the alternatives, the City Center Alternative would have the greatest adverse effect on PIF species. A total of 180 acres of PIF habitat, 8 acres of sensitive flora habitat, and 6 acres of sensitive fauna habitat would be lost under the alternative. The proposed projects would not affect the habitats of other protected or sensitive species on the South Post or any protected or sensitive species on the North Post or Southwest Area.

No impacts on endangered, threatened, or sensitive species at the GSA parcel would be expected, as the area does not support such species.

4.8.4.4 Sensitive Natural Areas

4.8.4.4.1 Land Use Plan Update

Long-term moderate adverse effects would be expected. The discussion in Section 4.8.2.4.1 applies equally to a change from the 1993 land use plan to the City Center Alternative land use plan. In terms of the potential impact on sensitive natural areas, the differences between the Preferred Alternative land use plan and the City Center Alternative land use plan are negligible.

4.8.4.4.2 BRAC Implementation and Facilities Projects

Long-term moderate adverse effects would be expected. Projects proposed for EPG are in areas with wetlands, and projects proposed for the South Post could affect wetlands, riparian buffers, and resource protection areas. Approximate acreages of natural resources that could be affected under the City Center alternative include 2 acres of wetlands, 4 acres of riparian buffers, and 14 acres of RPAs.

No impacts on sensitive natural areas at the GSA parcel would be expected, as the area does not support such areas.

4.8.4.5 BMPs/Mitigation

The BMPs listed for the Preferred Alternative apply equally to the City Center Alternative to reduce the adverse effects of the City Center Alternative on biological resources.

4.8.5 ENVIRONMENTAL CONSEQUENCES OF THE SATELLITE CAMPUSES ALTERNATIVE

4.8.5.1 Vegetation

4.8.5.1.1 Land Use Plan Update

Long-term moderate adverse effects would be expected. The discussion in Section 4.8.2.1.1 largely applies to a change from the 1993 land use plan to the Satellite Campuses Alternative land use plan. In terms of the potential effect on vegetation, the differences between the Preferred Alternative land use plan and the Satellite Campuses Alternative land use plan are negligible, with one exception: under the Satellite Campuses Alternative land use plan the designation of the entire Davison Army Airfield and its buffer area as Professional/Institutional could lead to a loss of natural vegetation in the area in the future if, without the need for airfield buffer areas, development were to occur in the area. All areas designated as Environmentally Sensitive or Outdoor Recreation—the land use areas of most concern to natural resource management—under

the 1993 land use plan would be redesignated under the Satellite Campuses Alternative land use plan, as listed in Table 4.8-9

Table 4.8-9
Environmentally Sensitive and Outdoor Recreation land use designation changes under the Satellite Campuses Alternative land use plan

General area of post	1993 land use designations and Satellite Campuses Alternative land use designations	
	1993 Environmentally Sensitive land use designation changed to:	1993 Outdoor Recreation land use designation changed to:
EPG	n/a	n/a
Davison Army Airfield (west of Fairfax County Parkway)	Professional/Institutional	Professional/Institutional
Central and Western Southwest area	Range/Training	n/a
Eastern Southwest area (bordering Accotink Creek)	Community	n/a
Fort Belvoir North Post golf course (north of Kingman Road and west of HEC)	Community	Community, Professional/Institutional
Northeast North Post and North Post areas Near Route 1	Professional/Institutional, Community, Residential	Professional/Institutional, Community
South Post bordering Accotink Bay	Community, Industrial, Troop	Community
South Post golf course	n/a	Professional/Institutional, Community, Residential
South Post Eastern and Southern areas	n/a	Community, Residential

4.8.5.1.2 BRAC Implementation and Facilities Projects

Long-term moderate adverse effects would be expected. Effects on vegetation of the BRAC construction proposed on the South Post under the Satellite Campuses Alternative would be slightly less than those under the City Center Alternative (see Section 4.8.4.1.2). Projects on the North Post that are south of Kingman Road are in currently developed areas, and development under the Satellite Campuses Alternative on the Davison Army Airfield and the North Post golf course would be concentrated on previously developed areas. Overall, the Satellite Campuses Alternative disperses development on the Main Post and would directly disturb less area of natural vegetative community on the post than would the Preferred Alternative, but dispersing the loss of vegetated areas could have the indirect effect of causing more habitat fragmentation and more invasive species incursions. Table 4.8-10 identifies the types of vegetative communities that would be disturbed under the Satellite Campuses Alternative and the total area of projects proposed for different areas of the Post.

Table 4.8-10
Vegetative community types potentially affected by projects proposed under the Satellite Campuses Alternative

Area of Post	Vegetative community types potentially affected	Total approximate acres of projects proposed in area
Davison Army Airfield	(urban areas only)	56
North Post golf course	White pine	23
Other North Post	Hardwood, Virginia pine, loblolly pine	76
South Post–golf course	Hardwood	5
South Post–other areas	Hardwood	5

4.8.5.2 Wildlife

4.8.5.2.1 Land Use Plan Update

Long-term minor adverse effects would be expected. The discussion in Section 4.8.2.2.1 applies equally to a change from the 1993 land use plan to the Satellite Campuses Alternative land use plan. In terms of the potential effect on wildlife, the differences between the Preferred Alternative land use plan and the Satellite Campuses Alternative land use plan are negligible.

4.8.5.2.2 BRAC Implementation and Facilities Projects

Long-term moderate adverse effects would be expected. Projects proposed under the Satellite Campuses Alternative would result in the loss of more than 100 acres of pine and hardwood vegetated areas that support a variety of wildlife species. Indirect effects on wildlife such as habitat loss and fragmentation and could also adversely affect wildlife species. Critical wildlife management areas such as the SNAs and areas bordering Accotink Bay would not be affected.

4.8.5.3 Endangered, Threatened, and Sensitive Species

4.8.5.3.1 Land Use Plan Update

Long-term minor adverse effects would be expected. The discussion in Section 4.8.2.3.1 applies equally to a change from the 1993 land use plan to the Satellite Campuses Alternative land use plan. In terms of the potential effect on protected and sensitive species, the differences between the Preferred Alternative land use plan and the Satellite Campuses Alternative land use plan are negligible.

4.8.5.3.2 BRAC Implementation and Facilities Projects

Long-term minor adverse effects would be expected. Projects proposed under the Satellite Campuses Alternative could affect fauna special species areas on EPG and the South Post. The effect of implementing the Satellite Campuses Alternative on sensitive and protected species would be nearly identical to the effect under the Town Center Alternative. Projects proposed on EPG could affect habitat of the prairie warbler, a PIF species, and a project on the South Post is proposed for an area that is occasionally used by bald eagles for foraging and that is designated as habitat for the worm-eating warbler, another PIF species. A total of 38 acres of PIF habitat, 2 acres of sensitive fauna habitat, and 2 acres of grassland management areas would be lost under the alternative. The proposed projects would not affect the habitats of other protected or sensitive

species on the South Post or any protected or sensitive species on the North Post or Southwest Area.

4.8.5.4 Sensitive Natural Areas

4.8.5.4.1 Land Use Plan Update

Long-term moderate adverse effects would be expected. The discussion in Section 4.8.2.4.1 applies equally to a change from the 1993 land use plan to the Satellite Campuses Alternative land use plan. In terms of the potential effect on sensitive natural areas, the differences between the Preferred Alternative land use plan and the Satellite Campuses Alternative land use plan are negligible.

4.8.5.4.2 BRAC Implementation and Facilities Projects

Long-term moderate adverse effects would be expected. Projects proposed for the North Post and South Post are in areas with wetlands, riparian buffers, and RPAs. Approximate acreages of natural resources that could be affected under the Satellite Campuses Alternative are 3 acres of wetlands, 24 acres of riparian buffers, and 44 acres of RPAs.

4.8.5.5 BMPs/Mitigation

The BMPs listed for the Preferred Alternative apply equally to the Satellite Campuses Alternative to reduce the adverse effects of the Satellite Campuses Alternative on biological resources.

4.8.6 NO ACTION ALTERNATIVE

Under the No Action Alternative, no effects would be expected on the biological resources of the installation.

4.8.7 SUMMARY OF COMPARISON OF ALTERNATIVES

Table 4.8-11 summarizes the overall impact of the Preferred Alternative and the other alternatives relative to each other on natural resources.

Main Post. The primary areas of biological resources concentration on the Main Post are the Southwest Area, land bordering the shores of the South Post, and the SNAs. All alternatives were conceived to avoid substantial development encroachment in the Southwest Area and the SNAs are protected from development, so it is the amount of development in the shoreline areas of the South Post that primarily determines the severity of the impact of each alternative on biological resources of the Main Post. Apart from the family travel camp (see Section 4.8.2.3.2), none of the alternatives have concentrations of development in the South Post shoreline zones. The alternatives would all reduce vegetated areas on the post by a substantial amount and could indirectly affect vegetative communities and wildlife through habitat fragmentation and isolation and increased occurrences of invasive species, which would result in a loss of ecological integrity.

EPG. Natural habitat on EPG has been re-establishing itself since the 1970s, when intensive training activities on EPG ceased. West of Accotink Creek, development has been minimal, and east of Accotink Creek, the developed areas have not been used intensively in recent years. Natural aspects of the area east of Accotink Creek—such as woody growth and the use of

undisturbed open areas by breeding birds—have increased. The Preferred and City Center Alternatives have the greatest adverse effects on the biological resources on EPG because they have more project development in EPG, while the Town Center and Satellite Campuses Alternatives have less development occurring on EPG.

Overall, therefore, the City Center Alternative would have the greatest adverse effect on the biological resources of Fort Belvoir, followed by the Preferred Alternative. The Town Center and Satellite Campuses Alternatives would have fewer impacts on biological resources than the other two alternatives. Non-BRAC projects, discussed in Section 5, Cumulative Effects, increase the effects on biological resources under all alternatives equally.

Table 4.8-11
Potential effects (in acres) on natural resources of BRAC projects under all alternatives

Natural Resource	Preferred Alternative	Town Center Alternative	City Center Alternative	Satellite Campuses Alternative
Wetlands	2	1	2	3
RPAs	14	18	14	44
Riparian buffers	6	11	4	24
Wildlife corridor	0	0	0	0
Grassland management areas	0	2	0	2
PIF breeding bird habitat	179	30	180	38
Sensitive flora habitat	8	0	8	0
Sensitive fauna habitat	6	2	6	2
EPG EQC	21	0	21	0

4.9 CULTURAL RESOURCES

Cultural resources are aspects of the physical environment that relate communities to their culture and history. They provide definition for communities and link them to their surroundings. Cultural resources include tangible remains of past activities that show use or modification by people. This type of cultural resource can include prehistoric and historic archaeological sites, buildings, structures, objects, or districts. Cultural resources can also include aspects of the natural environment, such as landscapes, specific places, topographic features, or biota, which are part of traditional lifeways and practices and are associated with community values and institutions.

4.9.1 AFFECTED ENVIRONMENT

4.9.1.1 Prehistoric and Historic Contexts of Fort Belvoir

The importance or significance of a cultural resource can be explained only when it is evaluated within its prehistoric or historic context. Contexts are those patterns or trends in history by which a specific resource is understood and its meaning (and ultimately its significance) within prehistory and history is made clear (NPS, 1997). The following section describes the major patterns of prehistory and history for Fort Belvoir and its vicinity.

4.9.1.1.1 Prehistoric Period

The Paleoindian Period represents the earliest known human occupation of North America, in the Mid-Atlantic region dating from 12,000 to 8,000 B.C., thus artifacts and sites from this time period are rare and very important. A fluted projectile point from this period has been found near Davison Army Airfield on Fort Belvoir (Fort Belvoir, 2006b). The Archaic Period dates from 8,000 to 1,000 B.C. and is noted by a shift to a heavier reliance on small game and an increased emphasis on plant foods compared to the Paleoindian Period. The Woodland Period dates from 1,000 B.C. to A.D. 1,600. Greater sedentism continued to develop, with two prominent site types—large base camps and small, briefly occupied foray camps. Artifacts from the Early Archaic through Woodland Period have been recovered at Fort Belvoir, including identifiable projectile points and ceramic fragments. The most common type of prehistoric site identified at Fort Belvoir is the lithic artifact scatter, but no diagnostic tools or ceramics have been recovered from these sites (Goodwin & Associates, 2001). Most of these sites were found on upland terraces and bluffs overlooking the three creeks (Accotink, Dogue, Pohick) and the Potomac River.

4.9.1.1.2 Historic Period

European Contact

Native Americans who lived in the region in which Fort Belvoir is located during the historical period include the Doeg (also spelled as Dogue) Indians, who controlled the middle portion of the Potomac River. The earliest Europeans to visit the area were Captain John Smith and his crew, whose expedition sailed up the Potomac River in 1608 as far as what is now Arlington County. Smith's famous map shows the main Doeg town of Tauxenent located on the Occoquan River, south of Fort Belvoir (Goodwin & Associates, 2001; Fort Belvoir, 2006b).

17th through 19th Centuries

European settlers arrived in present-day Fairfax County around 1664. Much of Northern Virginia, including the present location of Fort Belvoir, came under the ownership of a single family, the Fairfaxes, after whom Fairfax County, Virginia, was named. By the mid 18th century, multiple estates were established within and adjacent to present-day Fort Belvoir, including: Dennis McCarty's Cedar Grove and Mount Air (ca. 1718); William Fairfax's Belvoir (1741); George Washington's Mount Vernon (1742; 1757; 1787); and George Mason's Gunston Hall (1755) (Fort Belvoir, 2006b). Churches also were built in the area, including Pohick Church, which was constructed between 1769−1774 by the Anglican Truro Parish at the present-day intersection of U.S. Route 1 and Old Colchester Road. Industrial enterprises, such as George Washington's grist mill, were established in the area during the late 18th century, indicating that the surrounding population was substantial enough to require these services.

In 1783 the Belvoir estate was destroyed by fire. During the War of 1812, it was devastated again by British forces. By the 1820s, the estate had moved out of Fairfax family ownership. McCarty's Cedar Grove and Mount Air estates similarly changed hands and declined in those years. During this period, however, George Washington's nephew constructed Woodlawn Plantation (1800−1805) on a site that overlooked the Potomac River, near present-day Fort Belvoir. At about the same time, the village of Accotink developed around a grist mill near the intersection of Accotink Creek and Colchester Road (Fort Belvoir, 2006b).

In the mid 19th century, as large tobacco-producing manors worked by slaves were becoming a thing of the past, a new era began, during which settlers hailing from northern states moved to the area of present-day Fort Belvoir. The Society of Friends, or Quakers, was among these. The Society created a thriving community near Woodlawn, which had fallen on hard times. The Quakers were committed to nonviolence, education, and the use of progressive farming methods, and they opposed slavery. Before the Civil War, they established the Woodlawn Friends Meeting House and Burial Ground along present-day U.S. Route 1.

During the Civil War, the Belvoir area, removed from the major theater of operations, continued to develop in relative stability (Fort Belvoir, 2006b). The subdivision of some tobacco plantations, coupled with poor soil conditions and difficult economic times affected settlement patterns in the region. In the post-Civil War era, black and white communities developed strong social and cultural institutions in the area, including churches, schools, and clubs (Goodwin & Associates, 2001).

4.9.1.1.3 Federal Acquisition of Fort Belvoir

In 1910 the federal government acquired a 1,500-acre tract on the Belvoir peninsula. The property eventually came under control of the War Department for use by the U.S. Army as a training site for the U.S. Army Engineer School. Following the U.S. entry into World War I in 1917, a temporary cantonment, named Camp A.A. Humphreys in honor of Civil War Commander and former Chief of Engineers, Andrew A. Humphreys, was established in 1918 in the general vicinity of the present-day South Post. At that time, additional parcels were purchased, resulting in a dramatic transformation for this traditionally agrarian area (Fort Belvoir, 2006b).

To make the area suitable for military activity, roads, railroads, temporary buildings, and a water system were built. A water filtration plant, known as Camp A.A. Humphreys Pump Station and Filter Building, was erected on the site of the former Accotink Mill and survives today. By the end of World War I, nearly 55,000 personnel had been trained at the camp's multiple schools,

including the Engineer Replacement and Training Camp, the Engineer Officers' Training Center, the Army Gas School and the School of Military Mining. At the conclusion of the war, the camp became a demobilization center for troops making their way home. By 1919 the camp encompassed 6,000 acres, including the newly acquired area comprising the present-day North Post and Davison Army Airfield, and became the permanent home of the U.S. Army Corps of Engineers, relocated from present-day Fort McNair in Washington, DC (Fort Belvoir, 2006b).

4.9.1.1.4 Interwar Period

In 1922 the camp was designated a permanent post and renamed Fort Humphreys. The Engineers School offered training in a variety of fields, including forestry, road and railroad construction, camouflage, mining, surveying, pontoon construction, photography, printing, and cooking, and included the Reserve Officers Training Corps (ROTC) programs. The Engineer Board, a forerunner to the research and development (R&D) center at Fort Belvoir, was relocated to Fort Humphreys during this period (Fort Belvoir, 2006b). At this time, *temporary*, Craftsman-style, wood-frame houses (commonly referred to as *T-400s* housing) were designed and constructed (USACE, 2003).

During the interwar years, Fort Humphreys further evolved as it became the focus of an intense Army-wide building program designed to replace the majority of temporary buildings hastily constructed during World War I. Around 1926, the U.S. Army Quartermaster Corps developed standardized architectural plans for installations throughout the nation. The plans were adapted to local climatic and building traditions. In the Mid-Atlantic region, where Fort Humphreys was located, they included red brick, Georgian-Colonial-Revival-style buildings (Fort Belvoir, 2006b).

From the mid 1920s to the mid 1930s, most, but not all, of Fort Humphrey's temporary buildings were replaced with permanent construction, including officers' housing, barracks, and a hospital designed in the Colonial Revival style. The site plan of the installation was redesigned, creatively combining contemporary design philosophies of City Beautiful and Garden City influences with a more traditional collegiate approach, resulting in a landscape that maintained practicality while responding to natural surroundings in a flexible and aesthetic manner. Designed by George Ford and Howard Nurse, the layout focused on a structured, hierarchical collegiate center surrounded by residential areas with curvilinear streets. Support buildings were placed at the edge of the post plan. The Long Parade Field served as the anchor of the site, with administrative and classroom buildings along the east side, and barracks, a theater, gym, exchange, and post office on the west side (Fort Belvoir, 2006b). A cluster of two-story Colonial Revival-Style administrative and service buildings, originally constructed as barracks, separated the parade ground from the noncommissioned officers' housing. The park-like Belvoir Village, Gerber Village, Rossell Loop Village, and Jadwin Loop Village were characterized by curving streets and cul-de-sacs that limited traffic flow and promoted a secluded atmosphere. These residential areas, evocative of an early 20th-century garden suburb, included common green spaces and took advantage of natural landscape features and vistas.

In 1935 following a period of renewed interest in the history of the area, Fort Humphreys was officially renamed Fort Belvoir in reference to its historic association with William Fairfax's Belvoir Manor (Fort Belvoir, 2006b). The majority of the 1930s-era buildings at Fort Belvoir survives today, and forms the core of the Fort Belvoir Historic District (USACE, 2003), which is eligible to the National Register of Historic Places (NRHP). Despite significant expansion

throughout the 20th century, particularly in the northern portion of the installation, the historic landscape plan of the southern core has remained intact.

World War II

During the early 1940s, as the US was gearing up for entry into World War II, Fort Belvoir was expanded again through the acquisition of 3,000 acres north of U.S. Route 1 for the Engineer Replacement Training Center (ERTC). This expansion displaced the small, historic African-American community at Woodlawn (Fort Belvoir, 2006b). ERTC provided basic military engineer training to draftees. By 1942 when the United States had officially entered the war, it trained personnel to construct and operate Army installations and weapon operations, and an officer candidate school was established at Fort Belvoir.

As the nation approached involvement in World War II, the Corps' Engineer Board at Fort Belvoir coordinated a program of specialized equipment development and then led an effort to increase the number of laboratories and proving grounds available to test modern military equipment. By 1940 the Engineer Board secured Fort Belvoir's EPG property from local landowners. EPG's facilities started with ranges and buildings for landmine deployment and detection; however, during the war years, these facilities expanded to include vehicle testing buildings and structures, an airfield, laboratories and offices, range observation buildings, and ammunition storage magazines (New South Associates, 2006).

During World War II, another wave of temporary construction accommodated the massive influx of male and female inductees. Wood-frame housing was constructed for approximately 24,000 men and officers. Unlike their World War I era counterparts, these units were equipped with indoor plumbing, central heating, and electricity. At the conclusion of World War II in 1945, Fort Belvoir reprised its role as a demobilization center for the troops. After 1945 activity waxed and waned in accordance with peacetime policies (Fort Belvoir, 2006b).

1946–Present

During the height of the Cold War in the 1950s, Fort Belvoir became heavily involved in R&D, to complement its original training mission. Many R&D activities were undertaken by the Engineer Research & Development Laboratories (ERDL), which became involved in a wide range of activities, including testing new techniques for electric power generation, camouflage and deception, fuel and materials handling, mine detection, and other projects.

Cold War-era innovation was reflected in numerous aspects of the built environment at Fort Belvoir. For example, in 1948–49, Albert Kahn & Associates, the Detroit-based architecture firm well known for its U.S. auto industry work, designed the prototype Thermo-Con House, a building that employed chemically treated concrete that rose from its foundation. The house, which survives today on Fort Belvoir's South Post, was touted as a demonstration of a method to rapidly construct low-cost, mass-produced housing (Fort Belvoir, 2006b).

During this period, Fort Belvoir experienced another housing construction boom following congressional passage of military housing construction bills sponsored by Senator Wherry and Congressman Capehart in 1949 and 1955, respectively. The purpose of the legislation was to provide federal funding to upgrade the living conditions of military personnel through the creation of additional Army family housing units. Other developments at Fort Belvoir during those years included the construction of the U.S. Army Package Power Reactor in 1957. Designed as the Army's first prototype nuclear generating plant, SM-1 (Stationary, Medium

Power–First Prototype) Nuclear Plant was used to generate electricity for commercial use and cut back on fossil fuel consumption. The plant was the first nuclear training facility for military personnel. The plant, which is still extant, operated from 1957 to 1973 (Fort Belvoir, 2006b) when the reactor was deactivated and the nuclear fuel removed. The plant was decommissioned in 1998.

Fort Belvoir's mission continued to expand during the Cold War with the establishment of multiple Army and DoD entities including DeWitt Hospital (1957), the Defense Systems Management College (1971) and the Defense Mapping School (1972). In 1988 the U.S. Army Engineer School transferred to Fort Leonard Wood. The MDW assumed operational control of Fort Belvoir. Since the conclusion of the Cold War in 1989, Fort Belvoir has continued to function as a key U.S. Army installation, hosting multiple tenants that support the Army's mission and providing essential administrative and basic operations support to these tenant organizations (Fort Belvoir, 2006b).

Development of ranges and facilities at EPG was most heavy from 1940 through the 1960s. The munitions-testing facility at EPG followed the U.S. Army Engineer School that left Fort Belvoir and transferred to Fort Leonard Wood, Missouri, in 1988, leaving the EPG largely unused since that time. Currently the only tenant at EPG is the U.S. Army Nuclear and Chemical Agency (USANCA), which occupies one building. The EPG landscape is gradually being reclaimed by nature (New South Associates, 2006).

4.9.1.2 Cultural Resources Compliance at Fort Belvoir

4.9.1.2.1 Statutes, Regulations, and Policy

A number of federal statutes address cultural resources and federal responsibilities regarding them. The long history of legal jurisdiction over cultural resources, dating back to the 1906 passage of the Antiquities Act (16 U.S.C. 431-433), demonstrates a continuing concern on the part of Americans for their cultural resources. Cultural resources include historic properties, as defined in the National Historic Preservation Act (NHPA); cultural items, as defined in the Archaeological and Historic Preservation Act (AHPA) and the Native American Graves Protection and Repatriation Act (NAGPRA); archaeological resources, as defined by the Archeological Resources Protection Act (ARPA); Indian-sacred sites to which access is provided under the American Indian Religious Freedom Act (AIRFA), as defined in Executive Order (EO) 13007; and collections and associated records, as defined at 36 CFR Part 79, *Curation of Federally Owned and Administered Collections*. Requirements set forth in this legislation, and their implementing regulations, define Fort Belvoir's responsibilities for management of cultural resources. Regulations applicable to the management of cultural resources include those promulgated by the Advisory Council on Historic Preservation (ACHP) and the National Park Service (NPS).

Foremost among these statutes is the NHPA of 1966, as amended (16 U.S.C. 470). Section 106 of the NHPA requires federal agencies to take into account the effect of federal undertakings on historic properties. Historic properties are cultural resources that are included in or eligible for inclusion in the NRHP. To be eligible for inclusion in the NRHP, a cultural resource must demonstrate a significant degree of physical integrity and meet one or more of the NRHP criteria for significance with respect to historical associations, cultural characteristics, and future research potential. The regulations that implement Section 106 (36 CFR Part 800) describe the process for identifying and evaluating cultural resources; assessing effects of federal actions on historic

properties; and consulting to avoid, reduce, or mitigate adverse effects. The NHPA does not require preservation of historic properties, but it does ensure that federal agency decisions concerning the treatment of these resources result from meaningful consideration of cultural and historic values, and identification of options available to protect the resources.

In addition, Army Regulation (AR) 200-4, *Cultural Resources Management*, and Department of the Army Pamphlet (PAM) 200-4, *Cultural Resources Management*, delineate the Army's policy for managing cultural resources to meet legal compliance requirements and to support the military mission. Fort Belvoir complies with these regulations as well.

4.9.1.2.2 Integrated Cultural Resources Management Plan (ICRMP)

In February 2001, Fort Belvoir adopted its ICRMP in compliance with AR 200-4, which requires that installations prepare plans, every 5 years, to assist them in appropriately managing and maintaining archaeological and historic architectural resources (Goodwin & Associates, 2001). The goals of the 2001 ICRMP include the following:

- Integrate cultural resources management into Fort Belvoir's operations and mission, consistent with federal, DoD, and Army regulations
- Develop programs to enhance project coordination, planning, and compliance
- Provide a basis for Programmatic Agreements (PAs) developed in compliance with Section 106 of NHPA
- Provide installation-specific procedures and recommendations for cultural resources management

The ICRMP establishes management strategies and standard operating procedures to assist Fort Belvoir in complying with federal laws and regulations concerning cultural resources management. The standards set forth procedures for dealing with archaeological and historic architectural resources largely based on Section 106 of NHPA and other Federal laws and regulations protecting cultural resources.

4.9.1.2.3 Fort Belvoir Historic District Maintenance Plan

In April 2001, a maintenance plan was prepared to provide proper maintenance guidance for multiple barracks, administrative, institutional, and recreational buildings in the Fort Belvoir Historic District. The maintenance plan includes existing conditions surveys. It outlines building maintenance issues and recommends historically appropriate repair schemes with their costs, in accordance with the *Secretary of Interior's Standards for Treatment of Historic Properties.*

4.9.1.2.4 Programmatic Agreements

A program-specific PA was signed by Fort Belvoir and the Virginia State Historic Preservation Officer (SHPO) in August 2003 to mitigate the adverse effects that implementing RCI would have on important historic resources both on and near the Main Post. The PA stipulates incorporation of multiple mitigation measures into the RCI development plans, including: context-sensitive design within and adjacent to National Register-eligible and -listed resources; historic property management procedures; alternatives to demolition; archaeological survey procedures; and documentation of historic resources.

A PA that addresses assessment and mitigation of potential adverse effects to historic properties from undertakings at Fort Belvoir is being developed for signature by Fort Belvoir, the USACE,

the Virginia SHPO, and the ACHP. The proposed BRAC action and land use plan update will fall under this PA. This PA will de developed in consultation with interested parties.

4.9.1.2.5 Status of Cultural Resource Identification Efforts at Fort Belvoir

Archaeological Investigations

Archaeological surveys have been completed for the entire installation at the Main Post and EPG, except for areas that have been identified as disturbed and thereby not likely to contain such resources. In 1994 the Virginia SHPO concurred that all required archaeological identification studies had been satisfactorily completed at the Main Post and EPG (Goodwin & Associates, 2001). More than 47 archaeological surveys and excavations had been conducted within the Main Post since the 1930s (Goodwin & Associates, 2001), including compliance surveys and excavations to comply with NHPA Sections 106 and 110. One comprehensive archaeological survey was conducted at EPG to comply with NHPA Section 110 (MAAR Associates, 1993). No archaeological studies have been completed at the GSA Parcel, which has been completely disturbed by construction activities.

Architectural Investigations

More than 16 architectural studies and evaluations have been conducted of buildings and structures at the Main Post. Reconnaissance-level survey of all pre-1946 properties has occurred, as well as recording and evaluation of 245 resources (Goodwin & Associates, 2001). A historic resource survey and evaluation was also conducted in 2006 (Milner & Associates, 2006). One comprehensive architectural survey has recently been conducted at EPG; this survey includes recording and evaluation of all extant properties (New South Associates, 2006). This report is under review by Fort Belvoir and will be submitted to the Virginia SHPO for consultation. No architectural studies have been completed at the GSA Parcel.

Cultural Landscape and Viewshed Investigations

In compliance with the RCI PA, a cultural landscape survey of the Main Post was recently completed and has received concurrence from the Virginia SHPO (Gray & Pape, 2004). Two viewshed impact studies have been conducted at Fort Belvoir, one of the Woodlawn Friends Meeting House (Fort Belvoir DPW ENRD, 2005b) and one for placement of equipment on top of the DeWitt Hospital (Fort Belvoir, 2005b). No landscape or viewshed studies have been conducted at the EPG or the GSA Parcel.

Future Planned Investigations

Survey and cultural resources documentation efforts outlined in the RCI PA and planned for future implementation include

- Historic American Buildings Survey (HABS) documentation of each type of National Register-eligible housing resource to be affected by implementation of RCI, including setting and surrounding landscape features
- Existing conditions survey of National Register-eligible housing, including interiors, exteriors and landscape features in historic housing areas
- Creation of an Internet-ready, multimedia presentation on the history of Army Family Housing at Fort Belvoir

In addition, Fort Belvoir also plans the following cultural resources initiatives over the next few years:

- Ongoing evaluation of resources that attain the National Register 50-year age criterion to be considered for inclusion in the NRHP-eligible Fort Belvoir Historic District
- Ongoing archaeological investigations to determine the significance of known sites, as appropriate, in accordance with NHPA Section 106 regulations and other authorities
- Historic building and district evaluation of approximately 50 buildings in the 300 Area in the southwest portion of the South Post

4.9.1.3 Archaeological Resources

The Area of Potential Effect (APE) under the NHPA is equivalent to the ROI under NEPA. For the proposed project and alternatives, the APE for archaeological resources includes areas within the external boundaries of the Main Post, EPG, and the GSA Parcel. The following sections present information on archaeological resources on these three parcels.

4.9.1.3.1 Known Archaeological Sites

A total of 301 archaeological sites, both prehistoric and historic, have been identified at the Main Post. Only one archaeological resource, an isolated prehistoric artifact evaluated as not eligible to the NRHP, has been discovered at EPG. Table 4.9-1 provides a summary of the sites' National Register status. A complete list of the sites is provided in the ICRMP (Goodwin & Associates, 2001).

Table 4.9-1
Eligibility status of known archaeological sites at the Main Post and EPG

NRHP status	Number	Percent
Not eligible	113	37%
Potentially eligible; not evaluated	177	59%
Determined eligible	11	3.5%
NRHP listed	1	0.5%
Total	**302**	**100%**

Source: Goodwin & Associates, 2001.

Both prehistoric and historic archaeological sites are throughout the Main Post with the most intensive concentration on Pohick Neck. Archaeological sites are most often along watercourses including creeks and larger rivers like those that run through or border Fort Belvoir.

One site, 44FX4, is listed on the NRHP. This site is the Fairfax plantation complex, which includes the Belvoir Mansion Ruins and adjacent Fairfax Grave Site. Phase II archaeological excavations were completed at the site in 1976 and additional excavations were completed in 1994 (Goodwin & Associates, 2001). The site consists of remnants of the main plantation house, associated outbuildings, and the gravesite.

Although the GSA Parcel has not been surveyed for archaeological resources, the parcel has been heavily disturbed by construction of the buildings (all warehouses) and parking areas, and by construction of the adjacent I-95 corridor. There are no recorded archaeological resources there, and because of the extent of disturbance, it is unlikely that intact archaeological resources are present.

4.9.1.3.2 Cemeteries

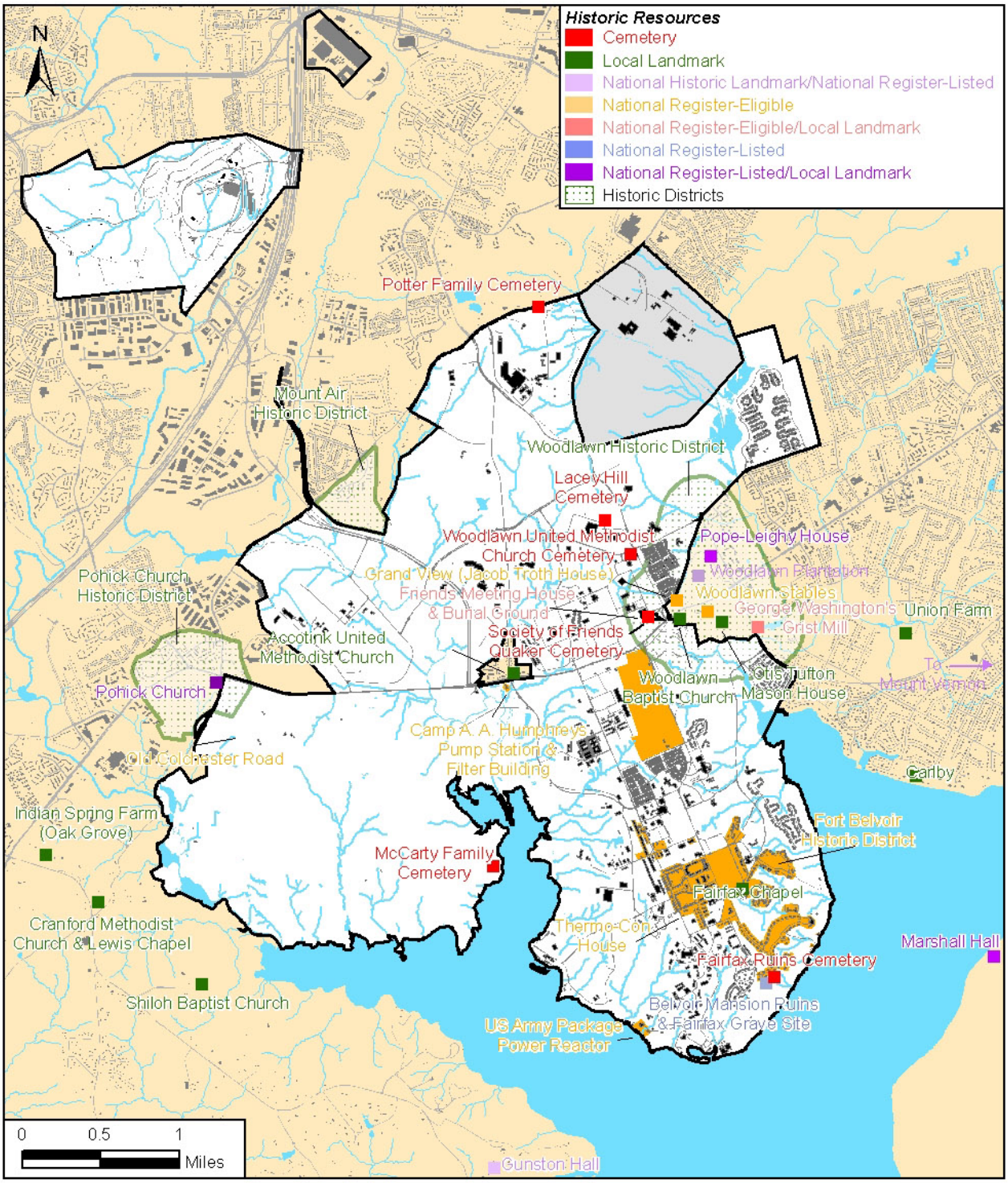
Six historic cemeteries are within the external boundaries of the Main Post. They are listed in Table 4.9-2 and shown on Figure 4.9-1. No cemeteries are at EPG or the GSA Parcel. Three of the cemeteries, Woodlawn United Methodist, Lacey Hill, and Society of Friends Quaker, are located on outgrants and not on land administered by Fort Belvoir.

Three archaeological investigations have been completed at three of the cemeteries. One study, completed in 1997, assessed the Lacey Hill and Woodlawn United Methodist cemeteries and concluded that although neither of the cemeteries was individually eligible for the National Register, they might contribute to a future Woodlawn African-American historic district (Goodwin & Associates, 2001). Another survey was completed at the Lacey Hill Cemetery, during the course of which 22 grave shafts were identified. The cemetery was identified as having been used until the late 1800s (Fort Belvoir DPW ENRD, 2002). Testing excavations were conducted at the Potter Family cemetery in 2005 and concluded that the cemetery is not eligible for the National Register. The Fairfax Ruins Cemetery is part of the National Register listing for Belvoir Mansion Ruins. The Quaker Cemetery is part of the Woodlawn Friends Meeting House property, which is a contributing resource to the National Register-eligible Woodlawn Historic District. The McCarty Family Cemetery has not been evaluated, and as such, is treated as potentially eligible until it is formally evaluated.

Table 4.9-2
Historic cemeteries at Fort Belvoir

Cemetery	Site number	Location	Ownership/ responsibility	National Register status
Woodlawn United Methodist Cemetery	44FX1210	Adjacent to North Post	Private congregation, out-grant	Not eligible individually; may be part of future historic district
Lacey Hill Cemetery	44FX1208	Adjacent to North Post	Private, out-grant	Not eligible individually; may be part of future historic district
Society of Friends Quaker Cemetery	44FX1211	Adjacent to North Post	Private congregation, out-grant	Contributes to the National Register-eligible Woodlawn Historic District
Potter Family Cemetery	44FX459	North Post	Fort Belvoir	Not eligible
Fairfax Ruins Cemetery	44FX4	South Post	Fort Belvoir	Listed as part of Belvoir Mansion Ruins property
McCarty Family Cemetery	44FX680	Southwest Area	Fort Belvoir	Not evaluated; potentially eligible

Sources: Goodwin & Associates, 2001; Fort Belvoir, GIS, 2006.



Historic Resources

Fort Belvoir, Virginia

Sources: Fort Belvoir GIS, 2006; Fairfax County GIS, 2006.

Figure 4.9-1

4.9.1.4 Architectural Resources

For the proposed project and alternatives, the APE for architectural resources includes those resources within the external boundaries of the Main Post, EPG, and the GSA Parcel that are listed, eligible for listing, or potentially eligible for listing on the National Register. Also included are resources in close proximity to the Main Post, EPG, and the GSA Parcel that are listed, eligible for listing, or potentially eligible for listing on the National Register and have been designated at the federal, state, or local levels (e.g.., National Register, Virginia Landmarks Register, Fairfax County Inventory of Historic Sites, or Fairfax County Historic District Overlays). Close proximity is defined as properties that are located near enough to the Fort Belvoir boundaries that they could possibly be affected by the proposed land use changes or BRAC projects.

The Main Post contains a number of historic architectural resources and additional resources in close vicinity. Table 4.9-3 lists these resources and Figure 4.9-1 shows the location of each resource. Not all Main Post architecture has been evaluated, thus there is the potential for additional resources to be found eligible for listing on the National Register. Pending completion of formal evaluation, Fort Belvoir is treating approximately 50 buildings in the 300 Area (southwest portion of the South Post) as potentially eligible until a formal evaluation can be conducted. These buildings are potentially eligible because of their role in Army research and development during the Cold War-era. There is the potential for a historic railway corridor with scattered associated railway resources that could form a multiple property resource eligible for listing on the National Register. And resources associated with Davison Army Airfield could be potentially eligible individually or as a district.

All extant properties within EPG have been recorded and evaluated. None are considered eligible for the National Register and none are designated on any state or local registers (New South Associates, 2006). A review of the Fairfax County Inventory of Historic Sites, current Fairfax County Historic District Overlays, the Virginia Landmarks Register, and the National Register shows that no listed resources or overlay districts are in close proximity to EPG.

The buildings and structures on the GSA Parcel are warehouses with small administrative offices and were constructed in 1953. None of these buildings has been evaluated for eligibility for listing on the National Register. Because of their age (54 years), these buildings would need to be evaluated before conducting any activities that would affect them. A review of the Fairfax County Inventory of Historic Sites, current Fairfax County Historic District Overlays, the Virginia Landmarks Register, and the National Register shows that no listed resources or overlay districts are in close proximity to the GSA Parcel.

Table 4.9-3
Historic architectural resources within and near Fort Belvoir, Virginia

Resource name	Location	Designation status	Virginia Department of Historic Resources (VDHR) /Fairfax County tax parcel number
Historic Resources within Fort Belvoir			
Fort Belvoir Historic District	South Post	National Register-eligible District; Virginia Landmarks Register; Fairfax County Historic Site	VDHR # 029-0209 Fairfax County Tax Parcel # 109-1,2,3,4
Army Family Housing at Rossell Loop, Jadwin Loop, and Park villages	South Post	Contributes to National Register-eligible /Virginia Landmarks Register-listed Fort Belvoir Historic District	VDHR # 029-0209-0312 (Rossell Loop Village) VDHR # 029-0209-311 (Jadwin Loop Village) VDHR # 029-0209-310 (Park Village)
Capehart-Wherry Era Army Family Housing	South Post: Dogue Creek Village Colyer Village George Washington Village River Village Fairfax Village North Post: Lewis Heights Village	National Register-eligible in accordance with Program Comment for Capehart-Wherry-Era Family Housing and Associated Structures and Landscape Features (1949–62) adopted by Advisory Council on Historic Preservation, May 31, 2002 Program comment fulfills Fort Belvoir's compliance obligations under Section 106 of NHPA for all actions that may affect Capehart-Wherry-Era housing at Fort Belvoir	Not applicable
Camp A.A. Humphreys Pump Station and Filter Building	South Post	National Register-eligible; Virginia Landmarks Register	VDHR # 029-0096
U.S. Army Package Power Reactor Multiple Property	South Post	National Register-eligible; Virginia Landmarks Register	VDHR # 029-0193
Thermo-Con House	South Post	National Register-eligible; Virginia Landmarks Register	VDHR # 029-5001
Belvoir Mansion Ruins and Fairfax Grave Site	South Post	National Register-listed; Virginia Landmarks Register	VDHR # 029-0041
Fairfax Chapel	South Post	Contributes to National Register-eligible/Virginia Landmarks Register-listed Fort Belvoir Historic District; Individually-designated Fairfax County Historic Site	VDHR # 029-0209 Fairfax County Tax Parcel # 115-2 ((1)) 1
Historic districts in close proximity to Fort Belvoir			
Mount Air historic overlay district			
Mount Air	North of North Post, bounded by Telegraph Road to the north, Fort Belvoir Military Railroad to the south and Accotink Road (Highway 637) to the east	Fairfax County Mount Air Historic Overlay District	Fairfax County Tax Parcel # 099-4 ((9)) A

Table 4.9-3
Historic architectural resources within and near Fort Belvoir, Virginia *(continued)*

Resource name	Location	Designation status	Virginia Department of Historic Resources (VDHR) /Fairfax County tax parcel number
Pohick Church historic overlay district			
Pohick Church	West of Fort Belvoir Southwest Area at junction of U.S. Route 1 and Old Colchester Road	National Register-listed; Virginia Landmarks Register; Fairfax County Pohick Church Historic Overlay District	VDHR # 029-0046 Fairfax County Tax Parcel # 108-1 ((1)) 27
Woodlawn historic district and overlay district			
Woodlawn Plantation	East of North Post, at junction of U.S. Route 1 and VA 235, Mount Vernon, VA	National Historic Landmark; National Register-listed; Contributes to National Register-eligible Woodlawn Historic District; Virginia Landmarks Register; Contributes to Fairfax County Woodlawn Historic Overlay District	VDHR # 029-0056 VDHR # 029-5181 (Historic District) Fairfax County Tax Parcel # 109-2 ((1)) 4
Pope-Leighy House	On grounds of Woodlawn Plantation (see above)	National Register-listed; Contributes to National Register-eligible Woodlawn Historic District; Virginia Landmarks Register; Contributes to Fairfax County Woodlawn Historic Overlay District	VDHR # 029-0058 VDHR # 029-5181 (Historic District) Fairfax County Tax Parcel # 109-2 ((1)) 4
George Washington Grist Mill	East of South Post, on east side of VA 235 Mount Vernon, VA	Contributes to National Register-eligible Woodlawn Historic District; Virginia Landmarks Register; Contributes to Fairfax County Woodlawn Historic Overlay District	VDHR # 029-0330 VDHR # 029-5181 (Historic District)
Alexandria (Woodlawn) Friends Meeting House and Burial Ground	Surrounded by North Post, at southwestern corner of Woodlawn Road and Lampert Road	Contributes to National Register-eligible Woodlawn Historic District; Contributes to Fairfax County Woodlawn Historic Overlay District	VDHR # 029-0172 VDHR # 029-5181 (Historic District) Fairfax County Tax Parcel # 109-2 ((1)) 38
Woodlawn Baptist Church	East of South Post, on southeastern corner of Woodlawn Road and Richmond Highway	Contributes to Fairfax County Woodlawn Historic Overlay District; Individually-designated Fairfax County Historic Site.	Fairfax County Tax Parcel # 109-2 ((1)) 1 VDHR # 029-5181 (Historic District)
Woodlawn Stables	East of South Post, on southern side of U.S. Route 1	Contributes to National Register-eligible Woodlawn Historic District; Contributes to Fairfax County Woodlawn Historic Overlay District	VDHR # 029-5181 (Historic District)
Grandview (Jacob Troth House)	On grounds of Woodlawn Plantation (see above)	Contributes to National Register-eligible Woodlawn Historic District	VDHR # 029-0062 VDHR # 029-5181 (Historic District)
Individual historic resources in close proximity to Fort Belvoir			
Accotink United Methodist Church	9401 Backlick Road; surrounded by North Post	Fairfax County Historic Site; potentially eligible to NRHP (not yet evaluated for NRHP eligibility)	Fairfax County Tax Parcel # 100-1 ((1)) 25
Carlby	4509 Carlby Lane; Alexandria, east of South Post	Fairfax County Historic Site; potentially eligible to NRHP (not yet evaluated for NRHP eligibility)	Fairfax County Tax Parcel # 110-3 ((1)) 10

Table 4.9-3
Historic architectural resources within and near Fort Belvoir, Virginia *(continued)*

Resource name	Location	Designation status	Virginia Department of Historic Resources (VDHR) /Fairfax County tax parcel number
Cranford Methodist Church & Lewis Chapel	9912 Old Colchester Road, Lorton; west of Southwest Area	Fairfax County Historic Site; potentially eligible to NRHP (not yet evaluated for NRHP eligibility)	Fairfax County Tax Parcel # 114-1 ((1)) 1
Gunston Hall	10709 Gunston Road, Lorton; southwest of South Post	National Historic Landmark; National Register-listed; Virginia Landmarks Register; Fairfax County Historic Site	VDHR # 029-0050 Fairfax County Tax Parcel #119-1 ((1)) 1
Indian Spring Farm (Oak Grove)	9829 Gunston Road, Lorton; west of Southwest Area	Fairfax County Historic Site; potentially eligible to NRHP (not yet evaluated for NRHP eligibility)	Fairfax County Tax Parcel # 113-2 ((1)) 11, 11A
Marshall Hall	5 mi north of MD 210 and MD 227, Bryan's Road, MD; east of South Post	National Register-listed Maryland Inventory of Historic Properties (MIHP)	MIHP # CH-54 (A, B, C)
Mount Vernon	East of Fort Belvoir on Potomac River; 3200 Mount Vernon Memorial Highway, Mount Vernon, VA	National Historic Landmark; National Register-listed; Virginia Landmarks Register; Fairfax County Historic Site	VDHR # 029-0054 Fairfax County Tax Parcel # 110-2 ((1)) 12
Old Colchester Road	Borders western side of Southwest Area	National Register-eligible	VDHR # 029-0953
Otis Tufton Mason House	8907 Richmond Highway, on grounds of Woodlawn Plantation	Fairfax County Historic Site; potentially eligible to NRHP (not yet evaluated for NRHP eligibility)	Fairfax County Tax Parcel # 109-2 ((1)) 2
Shiloh Baptist Church	10226 Gunston Road, Lorton; west of Southwest Area	Fairfax County Historic Site; potentially eligible to NRHP (not yet evaluated for NRHP eligibility)	Fairfax County Tax Parcel # 114-3 ((1)) 2
Union Farm	9150 Union Farm Road, Lorton; east of Fort Belvoir	Fairfax County Historic Site; potentially eligible to NRHP (not yet evaluated for NRHP eligibility)	Fairfax County Tax Parcel # 110-1 ((1)) 10

4.9.2 ENVIRONMENTAL CONSEQUENCES OF THE PREFERRED ALTERNATIVE

Section 106 of NHPA requires federal agencies to take into account the effects of their actions on any district, site, building, structure or object included in, or eligible for inclusion in, the NRHP. AR 200-4 also requires the Army to adhere to Section 106 of NHPA for all federal undertakings. Implementing regulations for Section 106 established by the ACHP are contained in 36 CFR Part 800; Protection of Historic Properties, as amended in 2004. These regulations provide specific criteria for identifying effects on historic properties. Effects to cultural resources listed in, or eligible for listing in, the National Register are evaluated with regard to the Criteria of Adverse Effect set forth in 36 CFR 800.5(a)(1) (Table 4.9-4). The Fort Belvoir ICRMP provides further guidance in assessing effects of undertakings on cultural resources as shown in Table 4.9-5. The

PA being developed for Fort Belvoir would stipulate the procedures to be followed in assessing any adverse effects of the proposed BRAC projects and in determining appropriate mitigation.

There are 302 known archaeological sites in the APE. Of these, 189 sites are either listed on, eligible for, or potentially eligible for the National Register, and thereby fall under the purview of Section 106 of the NHPA and 36 CFR Part 800. There are six cemeteries in the APE; one is listed on the National Register, one is eligible for listing, and three are potentially eligible for listing. These five cemeteries are considered as archaeological sites under Section 106 of the NHPA. All the architectural resources in the APE and discussed in Section 4.9.1.4 fall under the purview of Section 106 of the NHPA. All NHL properties are listed on the National Register; all the Virginia Landmarks Register properties are National Register-eligible; and properties listed on the Fairfax County Inventory of Historic Sites qualify as potentially eligible, though formal evaluation is yet to be completed in consultation with the Virginia SHPO. The three Fairfax County Historic District Overlays are centered on historic district cores that are listed on, eligible for, or potentially eligible for the National Register and are designed to protect the settings of their associated historic properties.

Table 4.9-4
Criteria of adverse effect

Definition
"An adverse effect is found when an undertaking may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the National Register in a manner that would diminish the integrity of the property's location, setting, materials, workmanship, feeling, or association. Consideration shall be given to all qualifying characteristics of a historic property, including those that may have been identified subsequent to the original evaluation of the property's eligibility for the National Register. Adverse effects may include reasonably foreseeable effects caused by the undertaking that may occur later in time, be farther removed in distance or be cumulative." (36 CFR 800.5[a][1])
Examples of adverse effects
Adverse effects on historic properties include, but are not limited to the following • Physical destruction of or damage to all or part of the property • Alteration of a property, including restoration, rehabilitation, repair, maintenance, stabilization, hazardous material remediation and provision of handicapped access, that is not consistent with the Secretary's *Standards for the Treatment of Historic Properties* (36 CFR Part 68) and applicable guidelines • Removal of the property from its historic location • Change of the character of the property's use or of physical features within the property's setting that contribute to its historic significance • Introduction of visual, atmospheric or audible elements that diminish the integrity of the property's significant historic features • Neglect of a property which causes its deterioration, except where such neglect and deterioration are recognized qualities of a property of religious and cultural significance to an Indian tribe or Native Hawaiian organization • Transfer, lease, or sale of property out of federal ownership or control without adequate and legally enforceable restrictions or conditions to ensure long-term preservation of the property's historic significance (36 CFR 800.5[a][2])

Before initiating projects in accordance with the Preferred Alternative, Fort Belvoir would determine if any eligible or potentially eligible archaeological sites would be adversely affected by the project, in accordance with Section 106 of the NHPA and 36 CFR Part 800. Fort Belvoir would consult with the Virginia SHPO on its determination. If adverse effects would occur, Fort Belvoir would continue consultation with the Virginia SHPO and other interested parties to develop mitigation measures to avoid, minimize, or mitigate any adverse effects.

NHPA also includes provisions that specifically address lead agencies responsibilities when their activities involve NHL properties, a few of which are near Fort Belvoir. Section 110(f) of NHPA

outlines specific action that these agencies must take when NHLs could be directly and adversely affected by an undertaking. Section 110(f) states:

> Prior to the approval of any Federal undertaking which may directly and adversely affect any National Historic Landmark, the head of the responsible Federal agency shall, to the maximum extent possible, undertake such planning and actions as may be necessary to minimize harm to such landmark, and shall afford the Advisory Council on Historic Preservation a reasonable opportunity to comment on the undertaking.

ACHP must be included in any consultation following a determination by the lead agency that the undertaking would have an adverse effect on an NHL (36 CFR 800.10(c)). ACHP must notify the Secretary of the Interior and may request the Secretary of the Interior to provide a report to ACHP detailing the significance of the affected NHL under Section 213 of the NHPA, including measures to avoid, minimize, or mitigate adverse effects. ACHP would report the outcome of the Section 106 process to the Secretary of the Interior and the head of the agency responsible for the undertaking.

Table 4.9-5
Potential effects on cultural resources

Type of undertaking	Potential effect on architectural	Potential effect on archaeological
Building demolition	Demolition of a historic property is, by definition, an adverse effect.	Building demolition could adversely affect subsurface archaeological features and deposits through related actions, such as utility line removal and heavy machinery traffic.
New construction	New construction could introduce architectural, visual, audible or atmospheric elements that are out of character with adjacent or surrounding historic properties.	New construction generally involves site grading and excavation to accommodate the building and any ancillary utilities, parking areas, and other associated infrastructure. Any undertaking involving surface or subsurface disturbance of archaeological historic properties constitutes an adverse effect.
Building maintenance/repair	Maintenance and repair work on interiors generally would have no adverse effect. Repairs to exteriors of historic buildings generally would have no adverse effect if the *Secretary of the Interior's Standards for Rehabilitation* and other design guidelines are followed.	Grounds maintenance that involves surface or subsurface disturbance could affect archaeological resources.
Rehabilitation/major repair	Rehabilitation or major repairs would have an effect on historic buildings; however, that effect generally is not adverse if the *Secretary of the Interior's Standards for Rehabilitation* are followed.	Excavation or other activity in connection with building rehabilitation could affect archaeological resources if it involves subsurface disturbance.

Table 4.9-5
Potential effects on cultural resources *(continued)*

Ground disturbance/cleanup	Could adversely affect historic landscapes or introduce visual elements that are out of character with adjacent or surrounding historic properties.	Excavation or other activity involving surface or subsurface disturbance could affect archaeological resources. Examples of potentially harmful undertakings include utility line replacement or construction; fuel tank or other removal of environmental contaminants; parking lot construction; building construction.
Training activities	Could adversely affect historic landscapes by introducing visual or audible elements out of character with surrounding historic properties.	Depending on nature of activity, training could impact archaeological resources.

Source: Goodwin & Associates, 2001.

4.9.2.1 Land Use Plan Update

Long-term minor adverse and beneficial effects could occur to historic properties as a result of implementing the Preferred Alternative land use plan. The determination of these effects is detailed below. The potential adverse effects to historic properties would include direct and indirect effects to their integrity (i.e., physical harm or change) and direct visual or noise effects to their setting. These adverse effects would arise from changing land use designations from nondevelopment to development and subsequent implementation of projects in accordance with the new land use designations. Historic properties that could be adversely affected include eligible and potentially eligible archaeological sites, Pohick Church, Pohick Church Historic District, Old Colchester Road, the Mount Air Historic District, a potentially eligible railroad multiple property resource, the Friends Meeting House and Burial Ground, Woodlawn Historic District, the potentially eligible South Post golf course, and the eligible Fort Belvoir Historic District.

The potential beneficial effects to historic properties would include prevention of direct and indirect effects to their integrity (i.e., physical harm or change) and direct visual effects to their setting. This protection would arise from changing land use designations from development to nondevelopment and subsequent restriction of projects in accordance with the new land use designations. Historic properties that could be beneficially affected include potentially eligible archaeological sites, Pohick Church, Pohick Church Historic District, Old Colchester Road, potentially eligible airfield historic resources, the Friends Meeting House and Burial Ground, Woodlawn Historic District, Carlby, Union Farm, and Mount Vernon.

Under the Preferred Alternative, the Troop Housing on the North Post would change to Professional/Institutional uses and an Industrial area on the South Post would be converted to Troop uses. However, implementation of these changes could be delayed because of funding concerns, resulting in the current uses of these areas being continued indefinitely. The following analysis of the adverse and beneficial effects of the Preferred Alternative includes both situations.

4.9.2.1.1 EPG

There are no historic properties within or near the EPG; therefore, changes in planned land use would have no effect on historic properties.

4.9.2.1.2 Southwest Area

Adverse Effects. A portion of the area designated as Environmentally Sensitive in 1993 would be changed to Training. This area contains potentially eligible archaeological sites. Although the proposed designation would not allow development, training use of the area could result in direct and indirect adverse physical effects to the potentially eligible sites. Training in this area could also result in direct adverse auditory effects to Pohick Church, Pohick Church Historic District, and Old Colchester Road.

Beneficial Effects. Areas designated as Industrial and Administration & Education in 1993 would be changed to Training. These areas are adjacent to Pohick Church, Pohick Church Historic District, and Old Colchester Road. The proposed change would prevent development near these historic properties, protecting them from direct adverse visual effects. Also, these areas contain potentially eligible archaeological sites. While training use of the areas could result in adverse effects to these sites, the Training designation would prevent development in these areas. Both of these would be beneficial effects.

4.9.2.1.3 Davison Army Airfield

Adverse Effects. Areas designated as Environmentally Sensitive in 1993 would be changed to Airfield. The area includes three potentially eligible archaeological sites. The new designation would allow for development, thus making direct and indirect adverse physical effects to these sites possible. Also, lack of development along the Fort Belvoir Military Railroad has maintained the potentially eligible status of a railroad-themed multiple property resource. However, changing the designation to Airfield would allow for development and direct visual adverse effects to this resource. The Mount Air Historic District lies adjacent to the airfield. The change to Airfield would allow for development and direct visual adverse effects to this resource.

Beneficial Effects. The Davison Army Airfield would maintain its designation and use as an airfield. By maintaining the historic use of Airfield, these potentially eligible resources are likely to be used for their original purposes and are less likely to undergo major renovations.

4.9.2.1.4 North Post

Adverse Effects. The proposed southernmost Professional/Institutional area would contain an area previously designated in 1993 as Environmentally Sensitive. This area contains a potentially eligible archaeological site. With the Professional/Institutional designation, this area would be open for development, making direct and indirect adverse physical effects to this site possible. The area northwest of Fort Belvoir Elementary School would be redesignated from Environmentally Sensitive to Residential, taking a protected area and opening it up for possible development. This area contains an eligible archaeological site, and redesignation would make direct and indirect adverse physical effects to this site possible. The area to the east of the school would also change from Environmentally Sensitive to Residential. This area is adjacent to the Woodlawn Historic District and development here could result in direct adverse visual effects to the district.

Beneficial Effects. The northeast portion of the North Post has a 1993 designation of two Family Housing areas with a total of four potentially eligible archaeological sites. Under the Preferred Alternative, these areas would be redesignated as Community, which is less likely to be developed. Thus, the four sites are less likely to be adversely effected. This change would also make less likely the potential for direct adverse visual effects to the Woodlawn Historic District

from developments in these areas. A very small area just north of the Friends Meeting House and Burial Ground and surrounding the Center for Army Analysis would be changed from Administration & Education to Community. This change would make development less likely in this area and protect this historic property, and the Woodlawn Historic District of which it is a part, from direct adverse visual effects.

4.9.2.1.5 South Post

Adverse Effects. The South Post golf course would be redesignated as Professional/Institutional, opening this open space to development. Development here could result in direct and indirect adverse physical effects to one potentially eligible archaeological site and to the potentially eligible golf course, which is a contributing resource to the Fort Belvoir Historic District. Development in this area along Route 1 could also result in direct adverse visual effects to the Friends Meeting House and Burial Ground, a contributing property to the Woodlawn Historic District. East of Jadwin Loop along the river shore, an area designated in 1993 as Outdoor Recreation would be redesignated as Residential. This area contains a potentially eligible archaeological site, and with the proposed designation, this site would be at risk for direct and indirect adverse physical effects from development. In the southwest portion of the South Post, an area currently designated as Outdoor Recreation and Environmentally Sensitive would be changed to Community, opening this area to development. This could have an adverse visual effect on the viewshed of Gunston Hall.

Beneficial Effects. The eastern portion of the South Post would be redesignated from Administration & Education to Residential. The types of development likely under Residential are much less likely to be visible from historic properties across Dogue Creek and the Potomac River (such as Carlby, Union Farm, and Mount Vernon) than the types of construction likely under the 1993 designation. Also, landscaping and open spaces associated with residential developments could mimic natural open spaces, thereby disguising developments. The area adjacent to the southern end of Woodlawn Historic District is one of the areas that would be redesignated as Residential. Residential developments in this location would be easier to screen from view from the district. This change could result in protection of these historic properties from direct adverse visual effects. The area north of the proposed Troop area would be redesignated from Industrial to Community. This area contains one potentially eligible archaeological site, which could be more easily protected from development and direct adverse physical effects under the proposed designation.

4.9.2.2 BRAC Implementation and Facilities Projects

Long-term minor adverse effects could occur to historic properties as a result of some of the 20 proposed projects under the Preferred Alternative. The potential adverse effects to historic properties would include direct and indirect effects to their integrity (i.e., physical harm or change) and direct visual effects to their setting. Historic properties that could be adversely affected include the Fort Belvoir Historic District, one eligible and one potentially eligible archaeological sites, and the Friends Meeting House and Burial Ground.

Assessment of adverse effects depends on the exact location of the proposed projects and the specific design details of the projects. These details include such things as building materials, construction footprint, height of buildings, and building design. Many of these project details cannot be determined until Fort Belvoir initiates the project design process. Until these details are developed, the exact nature and extent of adverse effects cannot be determined. However, on the

basis of general locations and characteristics of the proposed projects, as compared with information on historic property locations, a broad assessment of potential effects could be made. The results of this assessment are presented in Table 4.9-6, which lists those proposed projects that have a potential to adversely affect cultural resources.

Table 4.9-6
Proposed projects with potential adverse effects to cultural resources under the Preferred Alternative

Project number	Project description	Description of potential effects
3	MDA Facility	Potential adverse visual effect to Fort Belvoir Historic District from construction of new building
4	Hospital	Potential adverse direct effect to Fort Belvoir Historic District (specifically the South Post golf course, which is a contributing property), and potential adverse direct and indirect effects to a potentially eligible archaeology site from construction of new building and ancillary facilities
6	NARMC HQ Building	Potential adverse direct effect to Fort Belvoir Historic District (specifically the South Post golf course, which is a contributing property) from construction of new building
10	Network Operations Center	Potential adverse visual effect to Fort Belvoir Historic District from construction of new building, storage, and satellite yard
11	USANCA Support Facility	Potential adverse visual effect to Fort Belvoir Historic District from building renovation
14	Administrative Facility	Potential adverse direct and visual effects to Fort Belvoir Historic District from renovation of four existing buildings
15	Access Control Point	Potential adverse visual effect to Friends Meeting House and Burial Ground from new construction
17	PEO EIS Administrative Facility and Network Enterprise Communications Facility	Potential adverse visual effect to Fort Belvoir Historic District from construction of three new buildings and two parking garages
18	Structured Parking Facility, 200 Area	Potential adverse visual effect to Fort Belvoir Historic District from construction of parking garage
20	MWR Family Travel Camp	Potential adverse direct and indirect effects to nearby eligible archaeology site from construction of family camp and associated infrastructure and increased access to the site by the public

There are no historic properties, architectural or archaeological, on the EPG. There are no historic properties listed on national, state, or county registers in close proximity to the EPG boundaries. Although proposed projects 1, 2, 7, 8, 9, 12, and 13 are the types of projects that could affect cultural resources, because they are on the EPG, they would have no potential to effect cultural resources. Proposed projects 5, 16, and 19 are either not activities that could affect cultural resources, or are in an area removed from historic properties. However, when conducting ground-disturbing activities, there is always the possibility that buried archaeological resources could be discovered.

Projects 3, 10, 11, 14, 17, and 18 would include construction of buildings, parking structures, and a satellite yard and renovation of existing buildings, all in the administrative area of the Fort Belvoir Historic District. Although the types of new facilities would fit within the current and

historic administrative use of this area, the introduction of new buildings and especially parking structures and a satellite yard could adversely affect the setting of the district. Renovation of existing buildings could adversely affect those buildings and could affect the district if the exteriors of the buildings are changed; however, because the use of the buildings would stay administrative, it is possible the changes could be minimal, thereby minimizing those effects.

Projects 4 and 6 would include construction of new medical and dental services buildings and associated parking and access, all on the current South Post golf course. The golf course is a contributing property to the Fort Belvoir Historic District, and there is a potentially eligible archaeological site located within the golf course property. Construction of the new buildings would directly affect the golf course and the Historic District. Depending on the specific locations of the new buildings, one potentially eligible archaeology site also could be adversely affected through construction, changes in erosion patterns, and inadvertent construction effects.

Project 15 would include construction of a controlled access point, with a small building, inspection station, addition of turning lanes, and other ancillary improvements. Although the development would be small, it would be very close to the Friends Meeting House and Burial Ground and would introduce potential adverse visual effects. Project 20 would include RV campsites, cabins, tent sites, a support facility, relocation of Johnson Road, and utility upgrades. This project would introduce potential direct and indirect effects to a nearby eligible archaeological site.

4.9.2.3 BMPs/Mitigation

Implementing the Preferred Alternative and the 20 proposed projects would have long-term minor adverse and beneficial effects on cultural resources. There are a number of measures that would be implemented in compliance with Section 106 of the NHPA and 36 CFR Part 800 that would avoid the adverse effects, or mitigate the adverse effects and reduce them to a minor level. These measures would be implemented through the PA being developed for Fort Belvoir. These measures are discussed below.

4.9.2.3.1 General BMPs

Certain standard BMPs are considered to be part of all projects conducted under this alternative. The BMPs that relate specifically to protecting cultural resources from adverse effects include the following:

- All National Register listed, eligible, and potentially eligible archaeological sites that are near proposed construction areas would be fenced during construction activities to prevent inadvertent effects.
- All National Register listed, eligible, and potentially eligible archaeological sites that are near proposed construction areas would undergo periodic monitoring to ensure fencing and avoidance measures are adequate in protecting the sites.
- Inadvertent discoveries of archaeological materials, human remains, or associated funerary objects would be treated in accordance with the NHPA, 36 CFR 800, and NAGPRA. Requirements for notification and security and protection of any discoveries would be included in construction contractors' contracts.

4.9.2.3.2 BMPs for Potential Adverse Effects to Archaeological Resources

Before initiating projects in accordance with the Preferred Alternative, Fort Belvoir would determine if any eligible or potentially eligible archaeological sites would be adversely affected by the project, in accordance with Section 106 of the NHPA and 36 CFR Part 800. Fort Belvoir would consult with the Virginia SHPO on its determination. If adverse effects would occur, Fort Belvoir would continue consultation with the Virginia SHPO and other interested parties to develop measures to avoid, minimize, or mitigate any adverse effects.

Facility construction usually causes ground disturbance to much more area than just the building footprint. These additional areas could include construction zones surrounding the facility, staging areas for equipment and machinery storage, parking areas, and rights-of-way for utilities including gas, electric, telephone, fiber optic, water, and sewer. Construction and use of these additional areas could cause direct and indirect adverse physical effects to archaeological sites. Any such areas would be included in project reviews and determinations conducted by Fort Belvoir in accordance with Section 106 of the NHPA and 36 CFR Part 800, as described above.

Potential adverse effects to archaeological resources that are identified for the proposed projects include direct physical effects from construction activities, and indirect physical effects from increased access by the public. The following measures would address these potential adverse effects and reduce them to a minor level.

- If avoidance and protection of archaeological sites are not feasible, measures would be implemented to mitigate the adverse effects, per the PA being developed between Fort Belvoir, the USACE, the Virginia SHPO, and the ACHP. The PA would be developed in consultation with interested parties. Measures could include the following:
  - Conducting data recovery excavation of prehistoric and historic deposits
  - Including a process in the PA to be followed for any inadvertent discoveries of archaeological materials, human remains, or associated funerary objects.
  - Developing public interpretation materials regarding cultural resources of the installation or region

When conducting ground-disturbing activities, there is always the possibility that buried archaeological resources would be discovered or unanticipated adverse effects would occur on sites that were to be avoided. All contracts for construction activities would include a process to be followed for any inadvertent discoveries of archaeological materials, human remains, or associated funerary objects. Although unanticipated adverse effects on historic properties from implementation of the Preferred Alternative are possible, compliance with Section 106 of the NHPA, 36 CFR Part 800, the installation's ICRMP, and the PA would be expected to mitigate any unanticipated effects.

4.9.2.3.3 BMPs for Potential Adverse Effects to Architectural Resources

Potential adverse effects to architectural resources that are identified for the Preferred Alternative and its 20 proposed projects include direct physical effects from construction, demolition, and renovation activities, and direct visual effects from renovation and construction within historic property settings and viewsheds. The following measures would address these potential adverse effects and reduce them to a minor level.

Fort Belvoir would complete compliance with Section 106 of the NHPA and 36 CFR Part 800. Historic building surveys and evaluations would be conducted in proposed project areas where no

such studies have been conducted, to determine if historic properties are in the APE of the proposed projects. This process would use more detailed project information and would result in a determination of any adverse effects. If there are adverse effects, project-specific measures would be developed to avoid or mitigate the adverse effects. This process would be conducted in consultation with the Virginia SHPO and interested parties. The PA being developed between Fort Belvoir, the USACE, the Virginia SHPO, and the ACHP would define the measures to be implemented. Development of the PA also would include consultation with interested parties. Measures could include the following:

- Conducting renovation activities in a manner that preserves the historical and architectural value of the property through compliance with the Secretary of the Interior's *Standards for Rehabilitation* and *Guidelines for Rehabilitating Historic Buildings*
- Using context-sensitive design for new buildings to match the style and appearance of surrounding historic buildings
- Designing landscapes, streetscapes, lighting, and signage to minimize visual intrusion
- Using vegetation, topography, and other methods to screen the views of new buildings from historic properties
- Conducting detailed recording of adversely affected historic properties in accordance with the Secretary of the Interior's *Standards and Guidelines for Architectural and Engineering Documentation* to include detailed historic contexts, plans, drawings, and photographs

4.9.3 ENVIRONMENTAL CONSEQUENCES OF THE TOWN CENTER ALTERNATIVE

4.9.3.1 Land Use Plan Update

Long-term minor adverse and beneficial effects could occur to historic properties as a result of implementing the Town Center Alternative land use plan. The determination of these effects is detailed below. The potential adverse effects to historic properties would include direct and indirect effects to their integrity (i.e., physical harm or change) and direct visual or noise effects to their setting. These adverse effects would arise from changing land use designations from nondevelopment to development and subsequent implementation of projects in accordance with the new land use designations. Historic properties that could be adversely affected include eligible and potentially eligible archaeological sites, Pohick Church, Pohick Church Historic District, Old Colchester Road, the Mount Air Historic District, a potentially eligible railroad multiple property resource, Woodlawn United Methodist Church Cemetery, the Friends Meeting House and Burial Ground, Woodlawn Historic District, the potentially eligible South Post golf course, and the eligible Fort Belvoir Historic District.

The potential beneficial effects to historic properties would include prevention of direct and indirect effects to their integrity (i.e., physical harm or change) and direct visual effects to their setting. This protection would arise from changing land use designations from development to nondevelopment and subsequent restriction of projects in accordance with the new land use designations. Historic properties that could be beneficially affected include potentially eligible archaeological sites, Pohick Church, Pohick Church Historic District, Old Colchester Road, potentially eligible airfield historic resources, the Friends Meeting House and Burial Ground, Woodlawn Historic District, Carlby, Union Farm, and Mount Vernon.

Under the Town Center Alternative, the Troop Housing on the North Post would change to Professional/Institutional uses, and an Industrial area on the South Post would be converted to Troop uses. However, implementation of these changes could be delayed because of funding

concerns, resulting in the current uses of these areas being continued indefinitely. The following analysis of the adverse and beneficial effects of the Town Center Alternative includes both situations.

4.9.3.1.1 EPG

There are no historic properties within or near the EPG; therefore, changes in planned land use would have no effect on historic properties.

4.9.3.1.2 Southwest Area

Adverse Effects. A portion of the area designated as Environmentally Sensitive in 1993 would be changed to Training. This area contains potentially eligible archaeological sites. Although the proposed designation would not allow development, training use of the area could result in direct and indirect adverse physical effects to the potentially eligible sites. Training in this area could also result in direct adverse auditory effects to Pohick Church, Pohick Church Historic District, and Old Colchester Road.

Beneficial Effects. Areas designated as Industrial and Administration & Education in 1993 would be changed to Training. These areas are adjacent to Pohick Church, Pohick Church Historic District, and Old Colchester Road. The proposed change would prevent development near these historic properties, protecting them from direct adverse visual effects. Also, these areas contain potentially eligible archaeological sites. While training use of the areas could result in adverse effects to these sites, the Training designation would prevent development in these areas. Both of these would be beneficial effects.

4.9.3.1.3 Davison Army Airfield

Adverse Effects. Areas designated as Environmentally Sensitive in 1993 would be changed to Airfield. The area includes three potentially eligible archaeological sites. The new designation would allow for development, thus making direct and indirect adverse physical effects to these sites possible. Also, lack of development along the Fort Belvoir Military Railroad has maintained the potentially eligible status of a railroad-themed multiple property resource. However, changing the designation to Airfield would allow for development and direct visual adverse effects to this resource. The Mount Air Historic District lies adjacent to the airfield. The change in designation to Airfield would allow for development and direct visual adverse effects to this resource.

Beneficial Effects. The Davison Army Airfield would maintain its designation and use as an airfield. By maintaining the historic use of the airfield, these potentially eligible resources are likely to be used for their original purposes and are less likely to undergo major renovation.

4.9.3.1.4 North Post

Adverse Effects. The proposed southernmost Professional/Institutional area would contain an area previously designated in 1993 as Environmentally Sensitive. This area contains a potentially eligible archaeological site. With the Professional/Institutional designation, this area would be open for development, making direct and indirect adverse physical effects to this site possible. The area surrounding Woodlawn United Methodist Church Cemetery would be changed from Community to Professional/Institutional. This change would make development around the cemetery more likely, thereby increasing the risk for direct adverse visual effects. The area northwest of Fort Belvoir Elementary School would be redesignated from Environmentally Sensitive to Residential, taking a protected area and opening it up for possible development. This

area contains an eligible archaeological site, and redesignation would make direct and indirect adverse physical effects to this site possible. The area to the east of the school would also change from Environmentally Sensitive to Residential. This area is adjacent to the Woodlawn Historic District, and development here could result in direct adverse visual effects to the district.

Beneficial Effects. In the 1993 land use plan, the northeast portion of the North Post has a Family Housing area that has not been developed. This area contains one potentially eligible archaeological site. Under the Town Center Alternative, this area would be redesignated as Community, which is less likely to be developed; thus, the site would be less likely to be adversely effected. This change would also make less likely the potential for direct adverse visual effects to the Woodlawn Historic District from developments in this area. An area north of the Friends Meeting House and Burial Ground would be changed from Administration & Education to Community. This change would make additional development less likely in this area and protect this historic property, and the Woodlawn Historic District of which it is a part, from direct adverse visual effects.

4.9.3.1.5 South Post

Adverse Effects. The South Post golf course would be redesignated as Professional/Institutional, opening this open space to development. Development here could result in direct and indirect adverse physical effects to one potentially eligible archaeological site and to the potentially eligible golf course, which is a contributing resource to the Fort Belvoir Historic District. Development in this area along Route 1 could also result in direct adverse visual effects to the Friends Meeting House and Burial Ground, a contributing property to the Woodlawn Historic District. East of Jadwin Loop along the river shore, an area designated in 1993 as Outdoor Recreation would be redesignated as Residential. This area contains a potentially eligible archaeological site, and with the proposed designation, this site would be at risk for direct and indirect adverse physical effects from development. . In the southwest portion of the South Post, an area currently designated as Outdoor Recreation and Environmentally Sensitive would be changed to Community, opening this area to development. This could have an adverse visual effect on the viewshed of Gunston Hall.

Beneficial Effects. The eastern portion of the South Post would be redesignated from Administration & Education to Residential. The types of development likely under Residential are much less likely to be visible from historic properties across Dogue Creek and the Potomac River (such as Carlby, Union Farm, and Mount Vernon) than the types of construction likely under the 1993 designation. Also, landscaping and open spaces associated with residential developments could mimic natural open spaces, thereby disguising developments. The area adjacent to the southern end of Woodlawn Historic District is one of the areas that would be redesignated as Residential. Residential developments in this location would be easier to screen from view from the district. This change could result in protection of these historic properties from direct adverse visual effects. The area north of the proposed Troop area would be redesignated from Industrial to Community. This area contains one potentially eligible archaeological site, which could be more easily protected from development and direct adverse physical effects under the proposed designation.

4.9.3.2 BRAC Implementation and Facilities Projects

Long-term minor adverse effects could occur to historic properties as a result of some of the 19 proposed projects under the Town Center Alternative. The potential adverse effects to historic

properties would include direct and indirect effects to their integrity (i.e., physical harm or change) and direct visual effects to their setting. Historic properties that could be adversely affected include the Fort Belvoir Historic District, Friends Meeting House and Burial Ground, and one eligible and one potentially eligible archaeological site.

On the basis of general locations and characteristics of the proposed projects, as compared with information on historic property locations, a broad assessment of potential effects could be made. The results of this assessment are presented in Table 4.9-7, which lists those proposed projects that have a potential to adversely affect cultural resources.

Table 4.9-7
Proposed projects with potential adverse effects to cultural resources under the Town Center Alternative

Project number	Project description	Description of potential effects
2	Secure Administration Facility	Potential adverse direct effect to Fort Belvoir Historic District (specifically the South Post golf course, which is a contributing property) from construction of new building
4	Hospital	Potential adverse visual effect to Friends Meeting House and Burial Ground from construction of new building
6	NARMC HQ Building	Potential adverse visual effect to Friends Meeting House and Burial Ground from construction of new building
8	Infrastructure	Potential adverse visual effect to Friends Meeting House and Burial Ground from construction of new buildings
11	USANCA Support Facility	Potential adverse visual effect to Fort Belvoir Historic District from building renovation
13	Child Development Center	Potential adverse direct effect to Fort Belvoir Historic District (specifically the South Post golf course, which is a contributing property) and potential adverse direct and indirect effects to one potentially eligible archaeological site from construction of new building
14	Administrative Facility	Potential adverse direct and visual effects to Fort Belvoir Historic District from renovation of four existing buildings
15	Access Control Point	Potential adverse visual effect to Friends Meeting House and Burial Ground from new construction
17	PEO EIS Administrative Facility and Network Enterprise Communications Facility	Potential adverse visual effect to Friends Meeting House and Burial Ground from new construction
18	Structured Parking Facility, 200 Area	Potential adverse visual effect to Fort Belvoir Historic District from construction of parking facility
20	MWR Family Travel Camp	Potential adverse direct and indirect effects to nearby eligible archaeology site from construction of family camp and associated infrastructure and increased access to the site by the public

Proposed projects 1, 3, 5, 7, 10, 12, 16, and 19 either are not activities that could affect cultural resources, or are in an area removed from historic properties. However, when conducting ground-disturbing activities, there is always the possibility that buried archaeological resources could be discovered.

4.9.3.3 BMPs/Mitigation

Implementing of the Town Center Alternative and the 19 proposed projects would likely result in long-term minor adverse and beneficial effects on cultural resources. The nature of the potential adverse effects is the same as that identified for the Preferred Alternative; thus, the BMPs that would be implemented to address the adverse effects would be the same as those described for the Preferred Alternative (see Section 4.9.2.3). These measures would be implemented in compliance with Section 106 of the NHPA, 36 CFR Part 800, and the PA to avoid or mitigate the adverse effects and reduce them to a minor level.

4.9.4 ENVIRONMENTAL CONSEQUENCES OF THE CITY CENTER ALTERNATIVE

4.9.4.1 Land Use Plan Update

Long-term minor adverse and beneficial effects could be expected to historic properties as a result of implementing the City Center Alternative land use plan. The determination of these effects is detailed below. The potential adverse effects to historic properties would include direct and indirect effects to their integrity (i.e., physical harm or change) and direct visual or noise effects to their setting. These adverse effects would arise from changing land use designations from nondevelopment to development and subsequent implementation of projects in accordance with the new land use designations. Historic properties that could be adversely affected include eligible and potentially eligible archaeological sites, Pohick Church, Pohick Church Historic District, Old Colchester Road, the Mount Air Historic District, a potentially eligible railroad multiple property resource, Woodlawn Historic District, and the eligible Fort Belvoir Historic District.

The potential beneficial effects to historic properties would include prevention of direct and indirect effects to their integrity (i.e., physical harm or change) and direct visual effects to their setting. This protection would arise from changing land use designations from development to nondevelopment and subsequent restriction of projects in accordance with the new land use designations. Historic properties that could be beneficially affected include potentially eligible archaeological sites, Pohick Church, Pohick Church Historic District, Old Colchester Road, potentially eligible airfield historic resources, the Friends Meeting House and Burial Ground, Woodlawn Historic District, Carlby, Union Farm, and Mount Vernon.

Under the City Center Alternative, the Troop Housing on the North Post would change to Professional/Institutional uses and an Industrial area on the South Post would be converted to Troop uses. However, implementing these changes could be delayed due to funding concerns, resulting in the current uses of these areas being continued indefinitely. The following analysis of the adverse and beneficial effects of the City Center Alternative includes both situations.

4.9.4.1.1 GSA Parcel

There is no potential for archaeological resources on the GSA Parcel, and there are no historic properties listed on national, state, or county registers near the GSA Parcel boundaries. Formal evaluation of the buildings on the GSA Parcel would need to be completed before initiating any projects; thus, the buildings are treated as potentially eligible in this EIS. The GSA Parcel was not included in the 1993 land use plan. Designation of the GSA Parcel as Professional/Institutional would allow for development, making direct adverse physical effects to these properties likely.

4.9.4.1.2 EPG

There are no historic properties within or near the EPG; therefore, changes in planned land use would have no effect on historic properties.

4.9.4.1.3 Southwest Area

Adverse Effects. A portion of the area designated as Environmentally Sensitive in 1993 would be changed to Training. This area contains potentially eligible archaeological sites. Although the proposed designation would not allow development, training use of the area could result in direct and indirect adverse physical effects to the potentially eligible sites. Training in this area could also result in direct adverse auditory effects to Pohick Church, Pohick Church Historic District, and Old Colchester Road.

Beneficial Effects. Areas designated as Industrial and Administration & Education in 1993 would be changed to Training. These areas are adjacent to Pohick Church, Pohick Church Historic District, and Old Colchester Road. The proposed change would prevent development near these historic properties, protecting them from direct adverse visual effects. Also, these areas contain potentially eligible archaeological sites. While training use of the areas could result in adverse effects to these sites, the Training designation would prevent development in these areas. Both of these would be beneficial effects.

4.9.4.1.4 Davison Army Airfield

Adverse Effects. Areas designated as Environmentally Sensitive in 1993 would be changed to Airfield. The area includes three potentially eligible archaeological sites. The new designation would allow for development, thus making direct and indirect adverse physical effects to these sites possible. Also, lack of development along the Fort Belvoir Military Railroad has maintained the potentially eligible status of a railroad-themed multiple property resource. However, changing the designation to Airfield would allow for development and direct visual adverse effects to this resource. The Mount Air Historic District lies adjacent to the airfield. The change to Airfield would allow for development and direct visual adverse effects to this resource.

Beneficial Effects. The Davison Army Airfield would maintain its designation and use as an airfield. By maintaining the historic use of the airfield, these potentially eligible resources are likely to be used for their original purposes and are less likely to undergo major renovation.

4.9.4.1.5 North Post

Adverse Effects. The proposed southernmost Professional/Institutional area would contain an area previously designated in 1993 as Environmentally Sensitive. This area contains a potentially eligible archaeological site. With the Professional/Institutional designation, this area would be open for development, making direct and indirect adverse physical effects to this site possible. The area northwest of Fort Belvoir Elementary School would be redesignated from Environmentally Sensitive to Residential, taking a protected area and opening it up for possible development. This area contains an eligible archaeological site, and redesignation would make direct and indirect adverse physical effects to this site possible. The area to the east of the school would also change from Environmentally Sensitive to Residential. This area is adjacent to the Woodlawn Historic District, and development here could result in direct adverse visual effects to the district.

Beneficial Effects. In the 1993 land use plan, the northeast portion of the North Post has a Family Housing area that has not been developed. This area contains one potentially eligible archaeological site. Under the City Center Alternative, this area would be redesignated as Community, which is less likely to be developed; thus, the site would be less likely to be adversely effected. This change would also make less likely the potential for direct adverse visual effects to the Woodlawn Historic District from developments in this area. A very small area just north of the Friends Meeting House and Burial Ground and surrounding the Center for Army Analysts would be changed from Administration & Education to Community. This change would make development less likely in this area and protect this historic property, and the Woodlawn Historic District of which it is a part, from direct adverse visual effects.

4.9.4.1.6 South Post

Adverse Effects. An area just north of Gerber Village would be redesignated from Community to Residential. This change would make development in this area likely. Because the area is adjacent to the Fort Belvoir Historic District, potential adverse visual effects could occur. East of Jadwin Loop along the river shore, an area designated in 1993 as Outdoor Recreation would be redesignated as Residential. This area contains a potentially eligible archaeological site, and with the proposed designation, this site would be at risk for direct and indirect adverse physical effects from development. . In the southwest portion of the South Post, an area currently designated as Outdoor Recreation and Environmentally Sensitive would be changed to Community, opening this area to development. This could have an adverse visual effect on the viewshed of Gunston Hall.

Beneficial Effects. The eastern portion of the South Post would be redesignated from Administration & Education to Residential. The types of development likely under Residential are much less likely to be visible from historic properties across Dogue Creek and the Potomac River (such as Carlby, Union Farm, and Mount Vernon) than the types of construction likely under the 1993 designation. Also, landscaping and open spaces associated with residential developments could mimic natural open spaces, thereby disguising developments. The area adjacent to the southern end of Woodlawn Historic District is one of the areas that would be redesignated as Residential. Residential developments in this location would be easier to screen from view from the district. This change could result in protection of these historic properties from direct adverse visual effects. The area north of the proposed Troop area would be redesignated from Industrial to Community. This area contains one potentially eligible archaeological site, which could be more easily protected from development and direct adverse physical effects under the proposed designation.

4.9.4.2 BRAC Implementation and Facilities Projects

Long-term minor adverse effects could be expected to historic properties as a result of some of the 20 proposed projects under the City Center Alternative. The potential adverse effects to historic properties would include direct and indirect effects to their integrity (i.e., physical harm or change) and direct visual effects to their setting. Historic properties that could be adversely affected include the Fort Belvoir Historic District, Friends Meeting House and Burial Ground, potentially eligible buildings in the GSA Parcel, and one eligible archaeological site.

On the basis of general locations and characteristics of the proposed projects, as compared with information on historic property locations, a broad assessment of potential effects could be made.

The results of this assessment are presented in Table 4.9-8, which lists those proposed projects that have a potential to adversely affect cultural resources.

There are no historic properties, architectural or archaeological, on the EPG. There are no historic properties listed on national, state, or county registers near the EPG boundaries. Although proposed projects 1, 3, 4, 6 through 10, 12, and 17 are the types of project that could affect cultural resources, because they are on the EPG, they would have no potential to effect cultural resources. Proposed projects 5, 16, and 19 are either not activities that could affect cultural resources, or are in an area removed from historic properties. However, when conducting ground-disturbing activities, there is always the possibility that buried archaeological resources could be discovered.

There is no potential for archaeological resources on the GSA Parcel, and there are no historic properties listed on national, state, or county registers near the GSA Parcel boundaries. Formal evaluation of the buildings on the GSA Parcel would need to be completed before demolition; thus, they are treated as potentially eligible in this EIS. It is likely that these warehouses are not eligible, and in this case, projects 2 and 13 would not adversely affect any historic properties.

Table 4.9-8
Proposed projects with potential adverse effects to cultural resources under the City Center Alternative

Project number	Project description	Description of potential effects
2	Secure Administrative Facility	Potential adverse direct effect to potentially eligible buildings in GSA Parcel from demolition of all existing structures
11	USANCA Support Facility	Potential adverse visual effect to Fort Belvoir Historic District from building renovation
13	Child Development Center	Potential adverse direct effect to potentially eligible buildings in GSA Parcel from demolition of all existing structures
14	Administrative Facility	Potential adverse direct and visual effects to Fort Belvoir Historic District from renovation of four existing building
15	Access Control Point	Potential adverse visual effect to Friends Meeting House and Burial Ground from new construction
18	Structured Parking Facility, 200 Area	Potential adverse visual effect to Fort Belvoir Historic District from construction of parking facility
20	MWR Family Travel Camp	Potential adverse direct and indirect effects to nearby eligible archaeology site from construction of family camp and associated infrastructure and increased access to the site by the public

4.9.4.3 BMPs/Mitigation

Implementing the City Center Alternative and the 20 proposed projects would likely result in long-term minor adverse and beneficial effects on cultural resources. The nature of the potential adverse effects is the same as that identified for the Preferred Alternative; thus, the BMPs that would be implemented to address the adverse effects would be the same as those described for the Preferred Alternative (see Section 4.9.2.3). These measures would be implemented in compliance with Section 106 of the NHPA, 36 CFR Part 800, and the PA to avoid or mitigate the adverse effects.

4.9.5 ENVIRONMENTAL CONSEQUENCES OF THE SATELLITE CAMPUSES ALTERNATIVE

4.9.5.1 Land Use Plan Update

Long-term minor adverse and beneficial effects could be expected to historic properties as a result of implementing the Satellite Campuses Alternative land use plan. The determination of these effects is detailed below. The potential adverse effects to historic properties would include direct and indirect effects to their integrity (i.e., physical harm or change) and direct visual or noise effects to their setting. These adverse effects would arise from changing land use designations from nondevelopment to development and subsequent implementation of projects in accordance with the new land use designations. Historic properties that could be adversely affected include eligible and potentially eligible archaeological sites, Pohick Church, Pohick Church Historic District, Old Colchester Road, the Mount Air Historic District, a potentially eligible railroad multiple property resource, potentially eligible airfield historic resources, the Woodlawn United Methodist Church Cemetery, and Woodlawn Historic District.

The potential beneficial effects to historic properties would include prevention of direct and indirect effects to their integrity (i.e., physical harm or change) and direct visual effects to their setting. This protection would arise from changing land use designations from development to nondevelopment and subsequent restriction of projects in accordance with the new land use designations. Historic properties that could be beneficially affected include potentially eligible archaeological sites, Pohick Church, Pohick Church Historic District, Old Colchester Road, the Friends Meeting House and Burial Ground, Woodlawn Historic District, Carlby, Union Farm, and Mount Vernon.

Under the Satellite Campuses Alternative, the Troop Housing on the North Post would change to Professional/Institutional uses and an Industrial area on the South Post would be converted to Troop uses. However, implementing these changes could be delayed due to funding concerns, resulting in the current uses of these areas being continued indefinitely. The following analysis of the adverse and beneficial effects of the Satellite Campuses Alternative includes both situations.

4.9.5.1.1 EPG

There are no historic properties within or near the EPG; therefore, changes in planned land use would have no effect to historic properties.

4.9.5.1.2 Southwest Area

Adverse Effects. A portion of the area designated as Environmentally Sensitive in 1993 would be changed to Training. This area contains potentially eligible archaeological sites. Although the proposed designation would not allow development, training use of the area could result in direct and indirect adverse physical effects to the potentially eligible sites. Training in this area could also result in direct adverse auditory effects to Pohick Church, Pohick Church Historic District, and Old Colchester Road.

Beneficial Effects. Areas designated as Industrial and Administration & Education in 1993 would be changed to Training. These areas are adjacent to Pohick Church, Pohick Church Historic District, and Old Colchester Road. The proposed change would prevent development near these historic properties, protecting them from direct adverse visual effects. Also, these areas contain potentially eligible archaeological sites. While training use of the areas could result in adverse

effects to these sites, the Training designation would prevent development in these areas. Both of these would be beneficial effects.

4.9.5.1.3 Davison Army Airfield

Adverse Effects. Areas designated as Environmentally Sensitive in 1993 would be changed to Professional/Institutional. The area includes three potentially eligible archaeological sites. The new designation would allow for development, thus making direct and indirect adverse physical effects to these sites possible. Also, lack of development along the Fort Belvoir Military Railroad has maintained the potentially eligible status of a railroad-themed multiple property resource. However, changing the designation to Professional/Institutional would allow for development and direct visual adverse effects to this resource. Changing the Airfield to a designation of Professional/Institutional would allow for incompatible development and risk direct adverse physical and visual effects to the potentially eligible airfield historic resources. The Mount Air Historic District lies adjacent to the airfield. The change to Professional/Institutional would allow for development near this historic property and direct adverse visual effects to this resource.

Beneficial Effects. There would be no beneficial effects to cultural resources from the land use change at Davison Army Airfield.

4.9.5.1.4 North Post

Adverse Effects. The proposed southernmost Professional/Institutional area would include an area previously designated in 1993 as Environmentally Sensitive. This area contains a potentially eligible archaeological site. With the Professional/Institutional designation, this area would be open for development, making direct and indirect adverse physical effects to this site possible. The area surrounding Woodlawn United Methodist Church Cemetery would be changed from Community to Professional/Institutional. This change would make development around the cemetery more likely, thereby increasing the risk for direct adverse visual effects. The area northwest of Fort Belvoir Elementary School would be redesignated from Environmentally Sensitive to Residential, taking a protected area and opening it up for possible development. This area contains an eligible archaeological site, and redesignation would make direct and indirect adverse physical effects to this site possible. The area to the east of the school would also change from Environmentally Sensitive to Residential. This area is adjacent to the Woodlawn Historic District, and development here could result in direct adverse visual effects to the district.

Beneficial Effects. In the 1993 land use plan, the northeast portion of the North Post has a Family Housing area that has not been developed. This area contains one potentially eligible archaeological site. Under the Satellite Campuses Alternative, this area would be redesignated as Community, which is less likely to be developed; thus, the site would be less likely to be adversely effected. This change would also make less likely the potential for direct adverse visual effects to the Woodlawn Historic District from developments in this area. A very small area just north of the Friends Meeting House and Burial Ground, and surrounding the Center for Army Analysis would be changed from Administration & Education to Community. This change would make development less likely in this area and protect this historic property, and the Woodlawn Historic District of which it is a part, from direct adverse visual effects.

4.9.5.1.5 South Post

Adverse Effects. East of Jadwin Loop along the river shore, an area designated in 1993 as Outdoor Recreation would be redesignated as Residential. This area contains a potentially eligible

archaeological site, and with the proposed designation, this site would be at risk for direct and indirect adverse physical effects from development. . In the southwest portion of the South Post, and area currently designated as Outdoor Recreation and Environmentally Sensitive would be changed to Community, opening this area to development. This could have an adverse visual effect on the viewshed of Gunston Hall.

Beneficial Effects. The eastern portion of the South Post would be redesignated from Administration & Education to Residential. The types of development likely under Residential are much less likely to be visible from historic properties across Dogue Creek and the Potomac River (such as Carlby, Union Farm, and Mount Vernon) than the types of construction likely under the 1993 designation. Also, landscaping and open spaces associated with residential developments could mimic natural open spaces, thereby disguising developments. The area adjacent to the southern end of Woodlawn Historic District is one of the areas that would be redesignated as Residential. Residential developments in this location would be easier to screen from view from the district. This change could result in protection of these historic properties from direct adverse visual effects. The area north of the proposed Troop area would be redesignated from Industrial to Community. This area contains one potentially eligible archaeological site, which could be more easily protected from development and direct adverse physical effects under the proposed designation.

4.9.5.2 BRAC Implementation and Facilities Projects

Long-term minor adverse effects could occur to historic properties as a result of some of the 19 proposed projects under the Satellite Campuses Alternative. The potential adverse effects to historic properties would include direct and indirect effects to their integrity (i.e., physical harm or change) and direct visual effects to their setting. Historic properties that could be adversely affected include the Fort Belvoir Historic District, Friends Meeting House and Burial Ground, potentially eligible buildings in Davison Army Airfield, one eligible archaeological site, Lacey Hill Cemetery, and Woodlawn United Methodist Church Cemetery.

On the basis of general locations and characteristics of the proposed projects, as compared with information on historic property locations, a broad assessment of potential effects could be made. The results of this assessment are presented in Table 4.9-9, which lists those proposed projects that have a potential to adversely affect cultural resources.

Proposed projects 4, 5, 6, 7, 16, and 19 are either not activities that could affect cultural resources, or are in an area removed from historic properties. However, when conducting ground-disturbing activities, there is always the possibility that buried archaeological resources could be discovered.

Projects 1 and 12 would include construction of two new buildings at Davison Army Airfield. The buildings at the airfield have not been formally evaluated for historic significance. The introduction of new buildings could adversely affect the setting of any potentially eligible properties.

Table 4.9-9
Proposed projects with potential adverse effects to cultural resources under the Satellite Campuses Alternative

Project number	Project description	Description of potential effects
1	NGA Administrative Facility	Potential adverse visual effect to potentially eligible buildings in Davison Army Airfield from construction of new building
2	Secure Administrative Facility	Potential adverse visual effect to Friends Meeting House and Burial Ground from construction of a new building
3	MDA Facility	Potential adverse visual effect to Friends Meeting House and Burial Ground from construction of a new building
8	Infrastructure	Potential adverse visual effect to Friends Meeting House and Burial Ground from construction of new buildings and bridge
10	Network Operations Center	Potential adverse visual effect to Lacey Hill Cemetery and Woodlawn United Methodist Church Cemetery from construction of new building, storage center, and satellite yard
11	USANCA Support Facility	Potential adverse visual effect to Fort Belvoir Historic District from building renovation
12	Child Development Center	Potential adverse visual effect to potentially eligible buildings in Davison Army Airfield from construction of new building
13	Child Development Center	Potential adverse visual effect to Friends Meeting House and Burial Ground from construction of a new building
14	Administrative Facility	Potential adverse direct and visual effects to Fort Belvoir Historic District from renovation of four existing building
15	Access Control Point	Potential adverse visual effect to Friends Meeting House and Burial Ground from new construction
17	PEO EIS Administrative Facility and Network Enterprise Communications Facility	Potential adverse visual effects to Lacey Hill Cemetery and Woodlawn United Methodist Church Cemetery from construction of three new buildings and two parking garage
18	Structured Parking Facility, 200 Area	Potential adverse visual effect to Fort Belvoir Historic District from construction of parking facility
20	MWR Family Travel Camp	Potential adverse direct and indirect effects to nearby eligible archaeology site from construction of family camp and associated infrastructure, and increased access to the site by the public

4.9.5.3 BMPs/Mitigation

Implementing the Satellite Campuses Alternative and the 19 proposed projects would likely result in long-term minor adverse effects and beneficial effects on cultural resources. The nature of the potential adverse effects is the same as that identified for the Preferred Alternative; thus, the BMPs that would be implemented to address the adverse effects would be the same as those described for the Preferred Alternative (see Section 4.9.2.3). These measures would be implemented in compliance with Section 106 of the NHPA, 36 CFR Part 800, and the PA to avoid or mitigate the adverse effects.

4.9.6 ENVIRONMENTAL CONSEQUENCES OF THE NO ACTION ALTERNATIVE

Under the No Action Alternative, future development at the installation would be conducted in accordance with the 1993 master plan, as amended in 2002. No adverse effects to cultural

resources would occur if the BRAC action was not implemented. The Fort Belvoir ICRMP would continue to provide strategic guidance for development of real property assets to ensure potential effects to historic properties are identified and mitigated.

4.9.7 SUMMARY OF COMPARISON OF ALTERNATIVES

4.9.7.1 Comparison of Land Use Plan Alternatives

Each alternative discussed above was analyzed to identify potential effects arising from changing the land use plan from the 1993/2002 plan to the proposed plan. Analysis focused on changes from nondevelopment designations to development, and vice versa. Table 4.9-10 compares each alternative to the Preferred Alternative with regard to the identified potential effects.

Minor adverse effects, including direct and indirect physical effects and direct visual and noise effects, could occur to both archaeological sites and historic resources under each of the alternatives. The nature of the effects is the same from one alternative to the next. Mitigation measures common to all the alternatives would avoid or reduce the adverse effects. Thus, from

Table 4.9-10
Potential effects to cultural resources from land use plan alternatives

Area	Town Center Alternative	City Center Alternative	Satellite Campuses Alternative
GSA Parcel	Not applicable	Adverse effects to potentially eligible historic buildings	Not applicable
EPG	Same as Preferred	Same as Preferred	Same as Preferred
Southwest Area	Same as Preferred	Same as Preferred	Same as Preferred
Davison Army Airfield	Same as Preferred	Same as Preferred	Same as Preferred except: (1) potentially eligible airfield historic structures could be adversely affected; (2) there would be no beneficial effects
North Post	Same as Preferred except: (1) Woodlawn United Methodist Church Cemetery could have adverse visual effects; (2) three fewer potentially eligible sites would be protected	Same as Preferred except: (1) three fewer potentially eligible sites would be protected	Same as Preferred except: (1) Woodlawn United Methodist Church Cemetery could have adverse visual effects; (2) three fewer potentially eligible sites would be protected
South Post	Same as Preferred	Same as Preferred except: (1) the potentially eligible site, the potentially eligible golf course, and Fort Belvoir Historic District would not have adverse physical effects; (2)Friends Meeting House and Burial Ground would not have adverse visual effects; (3) Fort Belvoir Historic District would have adverse visual effects	Same as Preferred except: (1) the potentially eligible site, the potentially eligible golf course, and Fort Belvoir Historic District would not have adverse physical effects; (2)Friends Meeting House and Burial Ground would not have adverse visual effects

Note: The No Action Alternative has no potential effects; thus, it is not included in this table.

a general perspective, the alternatives are very similar. Specific comparison of the land use alternatives at an impact-by-impact level is not possible until certain planned studies have been completed, including historic resource surveys in areas proposed for development.

4.9.7.2 Comparison of BRAC Project Alternatives

Assessment of specific adverse effects to historic properties from the proposed BRAC projects depends on the exact location of the proposed projects and the specific design details of the projects. These details include such things as building materials, construction footprint, height of buildings, and building design. Many of these project details cannot be determined until Fort Belvoir initiates the project design process. Until these details are developed, the exact nature and extent of adverse effects cannot be determined. However, for each of the alternatives, a broad assessment of potential effects was based on general locations and characteristics of the proposed projects, as compared with information on historic property locations.

A simple tally of the number of proposed projects under each alternative that could result in adverse effects shows that the Preferred Alternative has 10 such projects, Town Center Alternative has 11, City Center Alternative has 7, and Satellite Campuses Alternative has 13. However, this tally alone does not provide information on the number of resources that could be affected by each project or the type or extent of effects. A more detailed comparison of BRAC project alternatives is provided in Table 4.9-11 (next page).

Minor adverse effects could occur to archaeological sites and historic resources under all the BRAC project alternatives. The nature of the effects is the same between alternatives, and the same mitigation measures would be applied to avoid or reduce the effects. As such, like the land use plan alternatives, the BRAC project alternatives are also very similar.

Table 4.9-11
Potential effects to cultural resources from BRAC project alternatives

Cultural Resource	Preferred Action	Town Center Alternative	City Center Alternative	Satellite Campuses Alternative
Fort Belvoir Historic District (eligible)	3v, 10v, 11v, 14d, 14v, 17v, 18v	11v, 14d, 14v, 18v	11v, 14d, 14v, 18v	11v, 14d, 14v, 18v
Fort Belvoir Historic District golf course (potentially eligible)	4d, 6d	2d, 13d		
Friends Meeting House and Burial Ground (eligible)	15v	4v, 6v, 8v, 15v, 17v	15v	2v, 3v, 8v, 13v, 15v
Lacey Hill Cemetery (potentially eligible)				10v, 17v
Woodlawn United Methodist Cemetery (potentially eligible)				10v, 17v
archaeological site 44FX1328 (eligible)	20d, 20i	20d, 20i	20d, 20i	20d, 20i
archaeological site 44FX1933 (potentially eligible)	4d, 4i,	13d, 13i,		
GSA buildings (potentially eligible)			2d, 13d	
Davison Army Airfield buildings (potentially eligible)				1v, 12v

Note: The number refers to the Project Number and the letter refers to the type of effect as listed here:
d = direct physical effects
i = indirect physical effects
v = visual effects