Environmental Assessment

of the

Army Residential Communities Initiative (RCI) Properties at Fort Belvoir, Virginia

Prepared for

Garrison Commander,
Fort Belvoir, Virginia

Prepared by

US Army Corps of Engineers,
Mobile District

with Technical Assistance from

CH2MHILL
Herndon, VA

Contract DACW31-95-D-0045, DO#0021

JULY 2003

Environmental Assessment of the Army Residential Communities Initiative at Fort Belvoir, Virginia July 2003

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Finding of No Significant Impact (FONSI) for the Army Residential Communities Initiative at Fort Belvoir, Virginia

Pursuant to the Council on Environmental Quality (CEQ) regulations (40 CFR Parts 1500-1508) for implementing the procedural provisions of the National Environmental Policy Act (42 U.S.C. 4321 et seq.) and Army Regulation 200-2 Environmental Effects of Army Actions (revised as 32 CFR Part 651), the Army has conducted an Environmental Assessment (EA) of the potential environmental and socioeconomic effects associated with implementing the U.S. Army Residential Communities Initiative (RCI) at Fort Belvoir, Virginia.

Purpose and Need

The purpose of the proposed action is to improve military family housing at Fort Belvoir. Fort Belvoir has an urgent and immediate need to upgrade the housing provided on the installation for military service members and their families, which is largely deficient in square footage and configuration for modern families. The purpose of the proposed action is to improve the quality of the housing stock at Fort Belvoir, by enlarging and modernizing the housing units; to improve military families' access to better housing, by avoiding the turnaround time of the military funding and construction process; and to provide first-rate neighborhood centers and recreation facilities.

Proposed Action

Consistent with authorities contained in the 1996 Military Housing Privatization Initiative, the Army proposes to transfer the responsibility for providing family housing and ancillary supporting facilities to a partnership between the Army and a private development entity, to be known as Fort Belvoir Residential Communities, LLC (FBRC), a limited liability corporation. As its partner, Fort Belvoir has selected Clark Pinnacle Family Communities, LLC, a joint venture that was formed to develop and manage military housing. The Army has worked together with Clark Pinnacle in developing a Community Development and Management Plan (CDMP) to implement the RCI at Fort Belvoir.

In accordance with the CDMP, the Army proposes to convey to FBRC all 2,070 existing family housing units and to grant a 50-year[1] ground lease for the underlying land (up to 548 acres[2]) and additional previously disturbed land (82 acres), to allow construction of housing and a recreation center on this "swing space" land. Four existing non-housing buildings on this land will be transferred for demolition. Fort Belvoir also will lease additional disturbed land (up to 26 acres) and 5 existing buildings to FBRC for temporary construction support and long-term property management/maintenance use. These buildings and land will not be in the 50-year ground lease and Fort Belvoir may reclaim them for another use in the future.

FBRC would demolish approximately 1,630 units, construct approximately 1,630 new units, rehabilitate approximately 170 historic units, and maintain 270 recently renovated units. Of the housing that contributes to the Fort Belvoir Historic District, 86 buildings (26.5 percent) that are considered inappropriate for rehabilitation, based on their condition and siting, are proposed for demolition. Upon completion of redevelopment and rehabilitation, the total units of family housing will equal the current inventory of 2,070 housing units.

Alternatives Considered

Alternatives to the proposed action that were considered were: a partial privatization alternative, a private sector reliance alternative, and leasing alternatives. Those alternatives were considered unreasonable or unfeasible and therefore were not further evaluated in the EA. In selecting the land proposed for family housing and the Recreation Center and temporary construction support sites, the Army considered and rejected several other areas (including the Engineer Proving Ground) based upon operational and environmental constraints. As prescribed by CEQ regulations, the EA also evaluated the no action alternative, under which the Army would continue providing for family housing needs through traditional military construction and maintenance funding, obtained via the Congressional authorization and appropriations process.

Factors Considered in Determining That No Environmental Impact Statement is Required

The EA, which is attached and incorporated by reference into this Finding of No Significant Impact, examined the potential effects of the proposed action and the no action alternative on the following resources and topics of environmental and socioeconomic concern: land use, aesthetics and visual resources, air quality, noise, geology and soils, water resources, biological resources, cultural resources, socioeconomics (including environmental justice and protection of children), transportation, utilities, and hazardous and toxic substances.

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[1] The ground lease could be extended for an additional 20 years at the Army's option.

[2] Exact boundaries and acreage of the RCI parcels to be leased will be determined by a survey of metes and bounds and this total acreage is expected to be reduced.

Implementation of the proposed action will result in a combination of short-term and long-term adverse and beneficial effects. Adverse effects will not be significant with the mitigation commitments specified by the EA. There could be short-term adverse effects on aesthetics, air quality, noise, soils, surface water, biological resources, traffic, utilities and solid waste, associated with construction and rehabilitation activities. Long-term adverse effects would result from demolition of historic buildings, plus construction that could impact archeological sites, plus increased or redirected traffic. Long-term beneficial effects would be realized on land use, soils, surface water, groundwater, quality of life, utilities, and hazardous substances. A possible minor increase in population due to improved occupancy rates is not expected to result in appreciable population-driven effects over the long term.

Cumulative effects resulting from the proposed action with concurrent construction projects on Fort Belvoir would produce long-term adverse but not significant effects on air quality, traffic, and biological resources. Long-term cumulative beneficial effects on surface water will result from new stormwater management where none currently exists, which will offset cumulative increases in impervious surface. Future new stationary sources on the post may be subject to nonattainment New Source Review requirements, because of the potential cumulative post-wide net increase in NOx emissions, to which this project and other planned projects will contribute.

As part of the proposed action, the ground lease is expected to require FBRC to accomplish mitigation measures that will reduce, avoid, or compensate for potentially-significant adverse effects, pertaining to: limiting air quality emissions and documenting annual usage of NOx-emitting construction equipment; protection of surface waters and Chesapeake Bay Resource Protection Areas; stormwater quality and quantity best management practices, with particular attention to subwatersheds where impervious surface is nearing the 25% threshold; avoiding construction in areas surrounding small whorled pogonia (if present); tree replacement on Fort Belvoir; treatment measures for the demolition or alteration of historic buildings and viewshed, in accordance with an agreement document prepared in consultation with the Virginia State Historic Preservation Officer and other consulting parties; avoidance of archeological sites and preservation of archeological resources if discovered during site preparation. Mitigation measures included in the ground lease are enforceable as essential elements of the agreement defining the parties' obligations for carrying out RCI at Fort Belvoir. In addition, certain measures are proposed to further minimize adverse effects where mitigation is not required. No action affecting historic properties will be taken until Section 106 consultation is complete. All necessary permits will be obtained from the responsible agencies to ensure compliance with state and federal laws and regulations.

Conclusion

Based on the EA, it has been determined that implementation of the proposed action coupled with specified mitigation commitments will have no significant impact to the quality of the natural or human environment. Because no significant environmental impacts will result from implementation of the proposed action, an Environmental Impact Statement is not required and will not be prepared.

Public Comment

The Final EA and Draft FONSI have been made available for public review and comment for 30 days, from July 14 through August 13, 2003. Review copies of the EA and FONSI were available in the John Marshall, Lorton, Sherwood Hall, and Kingstowne branches of the Fairfax County Public Library; at the Fort Belvoir RCI Office; and on the installation web site at <http://www.belvoir.army.mil>. Copies were mailed to individuals and agencies on the distribution list presented in the EA. Additional copies were available during the public comment period by contacting the Residential Communities Initiative Office at Fort Belvoir, VA. The Garrison Commander, Fort Belvoir, has considered all comments received by August 13, 2003, as documented in the Administrative Record, before making a decision to sign this Final FONSI.

8/14/03

THOMAS W. WILLIAMS
Colonel, US Army
Garrison Commander, Fort Belvoir, Virginia

Date

Executive Summary

Introduction

The Military Housing Privatization Initiative (MHPI)[1], gives the Army new, alternative authorities for improvement and construction of military family housing. Privatization actions taken under the new authority are referred to as the Army Residential Communities Initiative (RCI). Under existing budgetary constraints, the Army is unable to address the critical housing needs of America's soldiers and their families. Under RCI, installations can leverage scarce public funds for construction, maintenance, management, renovation, replacement, rehabilitation, and development of Army family housing and ancillary supporting facilities.

Background

Fort Belvoir is located in southeastern Fairfax County, Virginia (VA), about 12 miles southwest of Washington, District of Columbia (DC), 10 miles from the Pentagon, and five miles from Alexandria, VA. The Main Post lies near the community of Mount Vernon, alongside the Potomac River, Dogue Creek, Gunston Cove, and Pohick Creek, about 85 miles upstream of the Chesapeake Bay. Fort Belvoir's main entrance (Pence Gate) is just off of U.S. Route 1 at Belvoir Road. Route 1 divides the Main Post into areas known as North Post and South Post. Fort Belvoir supports an installation working population of about 22,200 persons, including about 10,000 civilian employees and 4,400 military service members, as well as about 4,500 military family members living on post. Fort Belvoir also provides community services to many military retirees living in the greater metropolitan Washington area.

Fort Belvoir provides 2,070 family housing units in 12 distinct housing villages for military families. Unlike many other Army installations, Fort Belvoir's family housing units are available to permanent party military personnel stationed both at Fort Belvoir and elsewhere in the Washington metropolitan area. It is estimated that approximately 75 percent of the military personnel living at Fort Belvoir commute to work at locations throughout the Washington metropolitan area. Fort Belvoir's family housing was built between 1920 and 1980; 79 percent of the existing homes were built before the early 1960s and the remaining 21 percent in 1980. Architectural surveys at Fort Belvoir determined that a total of 211 buildings (256 housing units and 11 garages in Belvoir Village, Gerber Village, Jadwin, Park and Rossell Villages) are eligible for listing on the National Register of Historic Places, as contributing structures to the Fort Belvoir Historic District. Fort Belvoir's housing has been well maintained and the historic officer housing in Belvoir Village is spacious. However, most of the older units suffer from insufficient floor space, insufficient storage, and poor layout.

[1] Public Law 104-106, as amended, was originally enacted in Section 2801 of the 1996 Defense Authorization Act and is codified at Title 10 of the United States Code [U.S.C.] Sections 2871-85

Proposed Action and Alternatives

Fort Belvoir has an urgent and immediate need to upgrade the housing provided on the installation for military service members and their families. Current family housing at Fort Belvoir is largely deficient in square footage and configuration for modern families. The purpose of the proposed action is to improve the quality of the housing stock at Fort Belvoir, by enlarging and modernizing the housing units; to improve military families' access to improved housing, by reducing the turnaround time of the military funding and construction process; and to provide first-rate neighborhood centers and recreation facilities.

Consistent with authorities contained in the 1996 MHPI, the Army proposes to transfer the responsibility for providing family housing and ancillary supporting facilities[2] to a partnership between the Army and a private development entity. This partnership will be known as Fort Belvoir Residential Communities, LLC (FBRC), a limited liability company. As its partner, Fort Belvoir has selected Clark Pinnacle Family Communities, a joint venture between Clark Realty Capital, LLC, and Pinnacle Realty Management Company, that was formed to develop and manage military housing. The Army is working jointly with Clark Pinnacle to develop a *Community Development Management Plan* (CDMP) that will implement the transfer of family housing operations at Fort Belvoir to FBRC.

Under the proposed action, the Army will:

- Convey all 2,070 existing military family housing units and 11 detached garages in twelve existing housing villages to FBRC, to be either rehabilitated or demolished and replaced. Upon transfer, FBRC will assume responsibility for all family housing operations at Fort Belvoir. When redevelopment and rehabilitation are complete, the total units of family housing will equal the current inventory of 2,070 housing units.
- Provide FBRC with a 50-year ground lease for the land underlying these housing villages, which totals approximately 548 acres[3] and is 85.5 percent of the land area defined for troop and family housing use by the 1993 Master Plan. At the Army's option, the term of the lease could be extended for an additional 25 years.
- Provide a 50-year land lease, which could be extended by another 25 years, for two additional land. A 77-acre land area near the center of South Post will be developed first (referred to as "New South Post Village"), to allow families in existing housing to move into new housing while reconstruction or rehabilitation work occurs in existing housing areas. A new community recreation center will be built on a 5-acre area nearby.

[2] According to 10 U.S.C. 2871, the term *ancillary supporting facilities* means "facilities related to military housing units, including facilities to provide or support elementary or secondary education child care centers, day care centers, tot lots, community centers, housing offices, dining facilities, unit offices, and other similar facilities for the support of military housing." However, schools, dining facilities, and unit offices will not be considered as part of the proposed privatization of military family housing at Fort Belvoir. For the purposes of this document, *ancillary supporting facilities* also includes housing property management and maintenance facilities operated by the partnership.

[3] Exact boundaries and acreage of the RCI parcels to be leased will be determined by a survey of metes and bounds. Some portions of these study parcels that are not needed for future housing or ancillary facilities are expected to be removed, by the metes and bounds survey, from the parcels to be transferred.

- Transfer four existing non-housing buildings on the New South Post Village land for demolition and the existing Comcast satellite dishes on the industrial-use portion of the parcel would either be relocated or replaced by underground cable.)
- Lease additional disturbed land (up to 26 acres) and 5 existing buildings to FBRC for temporary construction support and long-term property management/maintenance use. These buildings and land will not be in the 50-year ground lease and Fort Belvoir may reclaim them for another use in the future.

A number of locations were considered before selecting the areas proposed for "swing space" housing, a new Recreation Center and temporary construction support facilities. Siting principles for new construction include focusing new development on previously disturbed areas and emphasizing pedestrian access in facility siting, by locating housing, services and employment centers close together. Selection of the location for New South Post Village and the 5-acre Recreation Center parcel adheres to these principles by siting the new village Recreation Center on previously disturbed land that is close to the South Post's community facilities.

Two temporary construction staging areas were selected from a number of potential sites, in an iterative screening process that considered environmental concerns, transportation, proximity to Route 1, adjacent operations, proximity to residential areas and the Accotink Bay Wildlife Refuge, historic viewshed, permitting requirements and the existing infrastructure needed to support the operations. The proposed construction support sites were previously cleared and partially paved.

The preferred alternative is the proposed action summarized above. The no action alternative is also evaluated in this EA. Other alternatives (Partial Privatization, Private Sector Reliance, and Off-Post Leasing) were determined to be not feasible and therefore are not evaluated in detail in this EA.

Environmental Consequences

The Environmental Assessment (EA) evaluates potential effects on land use, aesthetics and visual resources, air quality, noise, geology and soils, water resources, biological resources, cultural resources, socioeconomics (including environmental justice and protection of children), transportation, utilities, and hazardous and toxic substances. For each resource, the predicted effects from both the proposed action and the no action alternative are briefly described below.

Consequences of the Proposed Action

Land Use

Overall, the proposed action would result in long-term minor beneficial effects on installation land use. Locating the housing units in New South Post Village closer to community services is an improvement in land use (see "Land Use Planning Principle" in section 3.0). Existing residential areas would be improved for the designated land use through housing rehabilitation and redevelopment, although the land use designation of

these areas would not change. No areas that are currently used for family housing would be converted to other uses.

Fort Belvoir is currently developing an update to the 1993 Master Plan. Land use planning for the proposed action has been coordinated with the planning process for the updated (2004) Master Plan.

According to the Land Use GIS layer provided by Fort Belvoir DPW-L in June 2003, most of the land area (94 percent of 548 acres) proposed for transfer with the existing housing villages currently carries the land use designation of Troop and Family Housing. However, the boundaries of Belvoir, Colyer, Dogue Creek, Fairfax, George Washington, Gerber, Jadwin, Lewis Heights, Park and Rossell Villages, will be expanded to include approximately 31 acres total of land that was designated in the 1993 Master Plan as Administrative/Education. In addition, Dogue Creek and Lewis Heights Villages will be expanded to include approximately two acres of land that was designated as Community Facility.

For the proposed New South Post Village, the proposed action will result in a modification in land use designation from Administrative and Education (approximately 4 acres), Community Facilities (approximately 35 acres), Industrial (approximately 6 acres), and Outdoor Recreation (approximately 35 acres) to Family Housing.

The land use designations of these areas is being changed to Family Housing in the updated (2004) Master Plan.

Aesthetics and Visual Resources

Long-term minor beneficial effects would be expected. Rehabilitation of existing housing units that are currently in need of upgrading; construction of new, modern housing; and the addition of recreational areas, vegetated noise buffers, and native-plant landscaping within the housing communities affected by the proposed action would be expected to improve the aesthetic and visual appeal of the villages.

Construction of new garages in Belvoir and Gerber Villages will block the view of some green spaces, which in and of itself is an adverse effect. However, the additional storage space provided to the residents will eliminate the need for temporary storage sheds and allow residents to store belongings in the garages rather then in front, side, and back yards as is currently occurring, resulting in a beneficial effect. The ability to park cars in the garages, rather than on the street, will result in an overall improvement in the view of the neighborhood. Many of the existing garages in Belvoir Village do not meet the current size vehicle requirements causing residents to park on the street or in the driveway. In addition, design of elements in the historic areas including garages, street benches, street and yard lighting will be in accordance with the Programmatic Agreement. Therefore, construction of the new garages is expected to have an overall neutral effect to the views in Belvoir and Gerber Villages.

Air Quality

The proposed action will not exceed the *de minimis* criteria of 25 tons per year of volatile organic compounds or nitrogen oxides, due to the phasing of construction over time.

Therefore, a conformity determination was not required. The proposed action includes a construction support stone crusher, concrete batch plant, and wall panel assembly facility, which would be considered stationary sources on the installation during the construction period. The annual pollutant Potential to Emit from the proposed action would be below all of the specified Prevention of Significant Deterioration and Nonattainment Area significant emission increase levels. Therefore, the proposed action would not be subject to New Source Review.

Noise

Short-term adverse, but not significant, effects of noise in the annoyance range (70 decibels and above) for residents and wildlife would be expected during construction and rehabilitation activities. Implementation of the proposed action would be expected to result in additional sources of noise during construction activities due to the operation of construction equipment and construction activities in general. FBRC will respect distances and sound-mitigation techniques in regards to home replacement, new housing, and rehabilitation activities and will consult with the Fort Belvoir Industrial Hygienist and the representatives of sensitive receptors as needed during the project.

Geology and Soils

No effects to geology, topography, prime farmland, or seismic activity would be expected from the proposed action. Both short-term minor adverse effects and long-term minor beneficial effects to soils would be expected in those areas within the villages where demolition of existing houses and new construction are expected. In the short term, increased runoff and erosion would occur during site construction due to removal of vegetation, exposure of soil, and increased susceptibility to wind and water erosion. In the long term, implementation of the proposed action would decrease soil erosion from stormwater runoff through the creation of stormwater best management practices (BMPs), which are lacking in most of the villages.

Water Resources

Both long-term beneficial and short-term minor adverse effects would be expected for surface water as a result of storm water management during and after the construction of new housing villages. The proposed action will first and foremost avoid impacts to stream channels where practicable through proper development planning. There are anticipated to be impacts to storm channels and a short segment of intermittent stream. Mitigation for unavoidable impacts will be determined, in consultation with US Army Corps of Engineers and Directorate of Public Work & Logistics[4]-Environmental and Natural Resources Division. Where perennial streams exist near (or within) the village footprint boundary, development will be conducted in accordance with the Fairfax County Chesapeake Bay Preservation Ordinance and Environmental Quality Corridor Policy. Therefore, no significant impacts to the Resource Protection Areas (RPAs) are expected. There are also no significant impacts to the 100-year floodplain.

There will be a substantial increase in impervious surface outside the RPA; however this potential impact will be mitigated through standard storm water management practices, as

[4] Formerly DIS (Directorate of Installation Support)

detailed in the Fairfax County Public Facilities Manual. Where practicable, infiltration-type storm water management practices will be implemented, in an attempt to more closely mimic the hydrology of a vegetated site and reduce the impacts of concentrated flows. Currently, in most locations, storm water discharges directly to the stream channel without any water quality or quantity improvements. Therefore, stormwater flows will be reduced and water quality will be improved, compared to existing conditions, in areas where stormwater management is provided. As a result of this addition of water quality and quantity controls, the proposed action is expected to have a long-term beneficial effect on the surface waters.

In the short term, construction activities would increase surface erosion and increase the dissolved solid and sediment content in the storm water runoff water, in turn reducing water quality in the surface waters. However, storm water runoff during the construction phase in the villages and in the construction areas will be adequately controlled through implementation of a erosion and sediment control plan, consistent with the Fairfax County Public Facilities Manual and the Virginia Erosion and Sediment Control Handbook.

Long-term minor beneficial effects would be expected on groundwater because of storm water management measures envisioned that will promote infiltration. This would be expected to have a positive impact on groundwater recharge.

Biological Resources

Both short-term adverse and long-term beneficial effects would be expected to occur. Construction activities and associated clearing will cause temporary short-term adverse effects to the vegetation and wildlife. To the extent possible, existing stands of trees within the housing parcels will be left in place. In an effort to protect existing vegetation, forested areas that are not needed for housing or stormwater management will be removed from the boundaries of the proposed lease parcels by the metes and bounds survey. In addition, no additional clearing will take place for construction staging areas.

In accordance with the Army's policy on natural resource protection, construction activities will avoid impacts to the habitats of sensitive species. Therefore, no long-term adverse effects are expected for sensitive species.

Wetlands impacted during construction are expected to be minor due to the maintaining of forested buffers associated with streams that contain the majority of the wetland systems. Long-term effects are not expected because all impacts will be mitigated with compensation in the form of restoration, creation or enhancement. In accordance with the Army's policy on natural resource protection, construction activities will seek to avoid impacts to wetlands.

Cultural Resources

By definition, transfer of historic buildings to FBRC is considered an adverse effect under the National Historic Preservation Act. Other planned activities that are part of the proposed action will also result in adverse effects on historic properties. The undertaking is not expected to result in significant impacts, because adverse effects on historic properties will be mitigated in accordance with the Programmatic Agreement that is being developed

by the Army, the Virginia State Historic Preservation Officer (SHPO) and other consulting parties.

The strategy for Fort Belvoir's neighborhoods that contribute to the Fort Belvoir Historic District is to retain and rehabilitate all housing from the 1930s Colonial Revival Plan for the development of Fort Belvoir; to retain and rehabilitate examples of the 1920s wood-frame temporary housing; and to remove the remaining 1920s frame houses and the 1940s brick duplexes in Rossell Village, to allow redevelopment of housing villages within the limited land areas currently available. In all, 73.5 percent (155 of 211) of the historic buildings will be rehabilitated and 26.5 percent (56 of 211 buildings) of the historic buildings, those which have been determined to be inappropriate for rehabilitation based on their condition and siting, are proposed for demolition and mitigation in accordance with the Programmatic Agreement. Rehabilitation, alterations and additions are proposed for Fort Belvoir's historic houses to provide modern, functional, and convenient homes. To avoid or minimize adverse effects, interior and exterior rehabilitation will be conducted in accordance with the terms of the Programmatic Agreement that is currently being developed and the Secretary of the Interior's Treatment Standards for Rehabilitation.

Of the 22 archeological sites identified within or adjacent to the subject parcels, 9 sites will not be affected by the proposed action. Six sites that have been recommended as not eligible for listing on the National Register of Historic Places (NRHP) could be disturbed by construction. Seven sites that are potentially NRHP-eligible could be affected. Efforts will be made in final site planning to avoid these sites. If they could be affected by construction, the Army will undertake an archeological survey to determine their NRHP-eligibility and will consult with the Virginia SHPO to determine how to avoid or resolve an adverse effect on the affected sites.

Before the ground lease is finalized, the boundaries of the Belvoir Manor ruins and Fairfax family cemetery site will be reevaluated and verified by a field survey, to ensure that this site will be excluded from the ground lease. Direct and indirect impacts of new construction to this NRHP-listed site will be avoided in final planning and public access to the site will be maintained.

Socioeconomics

Short-term minor beneficial effects would be expected in the regional economy as a result of expenditures and employment associated with construction of new housing. Long-term beneficial effects on quality of life for Fort Belvoir residents also would be expected. The supply of 3-, 4- and 5-bedroom units on Fort Belvoir would be increased. The proposed action will improve the condition and aesthetic appeal of existing housing through replacement and rehabilitation, provide five new neighborhood community centers, a Welcome Center and a new Recreation Center, and improve other recreational facilities. The proposed action will provide a new Recreation Center on South Post, as well as five new neighborhood community centers and new or improved outdoor recreation (ballfields, tennis courts, fitness courses, tot lots, etc) within the villages. An existing baseball field and Skate Park that will be displaced by housing construction will be relocated.

An adverse effect upon an off-post private recreational organization has been identified. Fort Belvoir currently allows the Woodlawn Little League nonexclusive use of the

installation's McNaughton baseball fields in Woodlawn Village, under a no-cost license that would need to be terminated before the land transfer to FBRC. Other ballfields are available for their use. However, the Army is actively considering transferring this land (approximately 10 acres) to Fairfax County, perhaps in exchange for other County land.

Assuming the occupancy rate increases to 95 percent at build-out, compared to occupancy rates of 77 to 89 percent in recent years, there could be a minor increase in on-post population (about 367 people, or 5.3 percent above the on-post population in family housing of 6,968 persons at the 2000 Census). Minor population-driven effects on local schools, on-post demand for law enforcement, fire protection services, medical services, and family support services could result. No adverse effect on shops and services, or homeless services and other special programs would be expected to result.

Fort Belvoir has consulted with Facility and Planning Analysis staff of Fairfax County Public Schools (FCPS); analysis did not project a significant increase in student population from this proposed RCI action. Fort Belvoir will continue to work closely with Fairfax County Public Schools to address any issues that may arise as a result of RCI at Fort Belvoir.

Construction would have minor adverse effects on the minority population in the off-post neighborhood to the south of Woodlawn Village, such as construction traffic, fugitive dust and noise may affect, across Pole Road where the nearest residences are 100-150 feet from the edge of Woodlawn Village. Noise, dust, and traffic generated by construction would be minimized through construction plans.

Transportation

As a result of the proposed action to rehabilitate and replace units in existing housing villages, there will be increases in traffic on roadways on and surrounding Fort Belvoir. The overall impact of this added traffic is not considered significant. Many study area intersections are expected to be at or to exceed their theoretical capacity, with or without the proposed action , beyond those that are expected to do so without the proposed action. Additional trips generated by the RCI development do not result in any intersections within the study area exceeding their theoretical capacity, beyond those that are expected to do so without the proposed improvements. Planned projects by others for roadways surrounding Fort Belvoir have the potential to reduce congestion on roadways serving the area.

Utilities

Under the proposed action, long-term minor beneficial effects would be expected for the potable water supply. Areas of new construction would receive new delivery lines within the development area providing improved water delivery and reduced water exfiltration and loss. Under the proposed action, long-term minor beneficial effects would be expected for the sanitary sewer system. Areas of new construction would receive new wastewater collection lines within the development area. Under the proposed action, long-term minor beneficial effects would be expected for the electric system. Although not a certainty, this utility may be privatized in the near future, resulting in long-term beneficial effects as the system will be fully upgraded. Under the proposed action, long-term minor beneficial effects would be expected for the gas system. Furthermore, beneficial effects would result from the construction and renovations of the housing units with the installation of energy efficient materials and systems. Under the proposed action, long-term minor beneficial

effects would be expected for the communication system. The communication distribution system will be installed underground for all new areas of construction. In areas of renovation, the system will be a continuation of the existing overhead or underground system in place.

Short-term adverse (but not significant) effects would be expected from the debris associated with the construction, demolition, and rehabilitation of family housing units and initial increases in water and sewer demand until final reductions in usage are achieved after construction is complete.

Hazardous and Toxic Substances

Previous investigations identified petroleum, oil and lubricants (POL) products associated with active or removed USTs and ASTs within and adjacent to the RCI footprint. Closed and active POL and Solid Waste Management Units (SWMUs) currently exist within and adjacent to the RCI footprint. SWMUs also currently exist within and adjacent to the temporary stone crushing construction site. Within the RCI parcels, one site within Dogue Creek Village, north of unit #900 (PC# 97-3115), is undergoing active remediation of soil contaminated by heating oil leakage from multiple heating oil tanks from various buildings within Dogue Creek Village. Sites near the housing villages are also undergoing remediation of soil contaminated by heating oil leakage.

Hazardous materials (i.e., asbestos containing materials [ACM] and lead based paint [LBP]), have also been identified within housing units in the RCI footprint. Removal and disposal of these constituents will be performed only by qualified personnel.

During activities at the northern (panel construction and lumber storage) and the southern temporary construction sites (stone crushing activities and concrete plant), hazardous materials will be generated. All hazardous materials generated at these sites will be stored and disposed of in accordance with relevant and applicable federal and state of Virginia environmental laws. FBRC will be required to obtain their own RCRA small quantity generator permit from Virginia for the operation and maintenance of their facilities. Fort Belvoir will apply to the Department of the Army for a waiver to 10 U.S.C. Sec. 2692 to allow the FBRC to store small quantities of materials that contain hazardous constituents on post.

FBRC will coordinate with the Army to minimize disturbance or impacts affecting the current status of SWMU sites, closed POL sites, and on-going remedial activities on the RCI properties as well as the adjacent properties.

Cumulative Effects

Adverse but not significant cumulative effects during the eight-year construction phase on noise and traffic would be expected to occur, due to construction projects scheduled to occur concurrently with the family housing construction activities.

During this period of construction activity, adverse cumulative effects on air quality and the noise environment are expected due to construction projects scheduled to occur concurrently with the family housing construction activities. Other development projects (such as DCEETA, DAAF FS, INSCOM HOT, DTRA, DeWitt Hospital, and AMC) on the post that have begun or will be in operation concurrently with the proposed action have

projected emissions ranging from 19.8 tpy to 52.2 tpy for the years 2004-2008 (DIS-ENRD, August 2001). The combined impact of these sources, along with the proposed action will most likely cause stationary sources at the post to be subject to nonattainment NSR permitting requirements because of the potential post-wide NOx net increase above the NSR threshold of 25 tpy. The applicability of NSR requirements because of the potential post-wide NOx net increase will need to be reviewed again as these projects reach the air permitting and facility final design stage.

Cumulative traffic effects are expected in association with the temporary AMC Headquarters, DeWitt Hospital relocation and the DCEETA facility. Gunston and Kingman Roads on North Post and Gunston and Belvoir Roads on South Post would be expected to see increases in traffic volumes with these facilities. Long-term cumulative traffic effects with planned and potential projects are accounted for in the background traffic growth assumptions for the 2011 horizon year in the traffic analysis.

Increased impervious surface from all of these facilities will result in an increased volume of stormwater runoff; however the proposed stormwater management for each facility is anticipated to provide sufficient mitigation to prevent cumulative adverse impacts. There are substantial increases in impervious surface from the AMC and RCI projects within subwatershed 03. Both projects will mitigate with storm water management in order to prevent an increase in stormwater runoff in this area. Due to the added potential for cumulative impacts in this subwatershed, however, FBRC will specifically target this subwatershed for additional infiltration where practicable. Stormwater from the new North Post Chapel site will be specifically reviewed during development of the storm water management controls for Lewis Heights, to ensure there are no cumulative impacts. Because there is currently a limited amount of stormwater management in the RCI parcels, there is expected to be a beneficial impact on surface waters as a result of the proposed action. This is not anticipated to change as a result of cumulative effects from other projects.

Potential impacts to vegetation, wildlife, and wetlands from the RCI project are not expected to significantly increase overall effects from the relocation of DeWitt Hospital and of AMC headquarters and the construction of the New North Post Chapel. Moving the hospital will cause approximately 19 acres of mixed hardwood-pine forest to be cleared and 21 acres (including a mowed grass, a grass shrub strip, 3 acres of a wooded area and scattered landscape trees) will be impacted by the AMC project. Mitigation for these actions is to replace the trees with a 2:1 replacement ratio. Removal of vegetation from the combined projects will be compensated for in consultation with the Fort Belvoir Environmental Office. The Army has a policy of no net loss of wetlands; therefore, all potential impacts to wetlands will be compensated for on Fort Belvoir.

Consequences of the No Action Alternative

Only those resources that would be affected by the no action alternative are discussed below.

Aesthetics and Visual Resources

Long-term minor adverse effects would be expected. Under the no action alternative, the Army would be responsible for maintenance and renovation of existing housing, which

would occur more slowly than under the proposed action alternative and could result in some degree of visible deterioration over time. No action would result in a continuation of existing conditions including overhead utility lines and visibility of Lewis Heights housing from Woodlawn Plantation. This would be expected to adversely affect visual and aesthetic resources on and off the installation.

Surface Water Resources

No significant effects would be expected on surface water as a result of continuation of current stormwater management practices in conjunction with maintenance and repair of the housing within the existing villages. However, due to the lack of stormwater management in several locations under existing conditions, streams will continue to erode and adjust, creating steep and undercut stream banks, until a new, stable channel alignment is reached. This process can continue indefinitely if the watershed continues to develop or if the stream can not find a stable equilibrium.

Socioeconomics

Long-term minor adverse effects would be expected. Continuation of current family housing programs would perpetuate deficiencies in quality of life for some soldiers and their dependents. Availability of family housing that is both affordable and of high quality is a key function of quality of life and is often given high priority by soldiers and their families. Fort Belvoir would continue to perform regular maintenance on existing housing. Future renovation projects could occur at some point, but it would be on a constrained budget and therefore over a longer period of time, compared to the proposed action.

Hazardous and Toxic Substances

Minor adverse effects could occur. It is assumed that Fort Belvoir will continue to control and abate the potential hazards posed by ACM and LBP in accordance with applicable laws and regulations, but future abatement actions may be over a greater period of time than under the proposed action. No additional adverse effects beyond those currently present from the actual and suspected hazardous or POL materials in the RCI foot print would occur.

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1 Purpose, Need, and Scope

This section begins with a brief summary of the Army's proposed action under the Army's Residential Communities Initiative. (See Section 2.0 for details about the proposed action.) Section 1.1 describes the background of the military housing privatization initiative and Fort Belvoir. Section 1.2 discusses the purpose and need for the proposed action. Section 1.3 outlines the scope of this environmental assessment (EA) and section 1.4 describes the way public input has been incorporated into the study process.

The Army proposes to transfer the responsibility for providing military family housing to a partnership between the Army and a private development entity. This partnership will be known as the Fort Belvoir Residential Communities, LLC (FBRC), a limited liability company. The Army is working jointly with the selected development entity to develop a *Community Development and Management Plan* (CDMP) that will implement the transfer of family housing operations at Fort Belvoir to FBRC.

Under the proposed action, the Army will:

- Direct the implementation of the CDMP that will have been negotiated with and approved by the installation.
- Convey all its existing military family housing units and grant a 50-year ground lease for the areas on which the housing and facilities are located, to FBRC. At the Army's option, the term of the lease could be extended for an additional 25 years.
- Include in the ground lease enough additional land (not currently used for housing) to construct "swing housing" and community amenities.
- Upon completion of redevelopment and rehabilitation, the total number of homes for soldiers and their families on Fort Belvoir will not differ from the current inventory of 2,070 family housing units.

1.1 Background

1.1.1 Military Housing Privatization Initiative

The Department of the Army (DA or Army) operates and maintains approximately 90,000 family housing units at its installations throughout the United States. More than 75 percent of the units do not meet current Army housing standards. Despite this, at most installations demand for adequate on-post housing exceeds supply. The lack of adequate housing forces many military families to live in housing that is in need of repair or renovation or to live off-post, where the cost and quality of housing varies considerably. Often, the costs to military personnel and their families to live off-post are 15 to 20 percent greater than the costs to live on-post. The Army estimated that as much as $6 billion would be needed to bring its housing up to current standards and to address the deficit of housing (Army Residential Communities Initiative Website, 2001).

In recognition of these problems, Congress enacted Section 2801 of the 1996 Defense Authorization Act (Public Law 104-106, as amended, codified at Title 10 of the United States Code [U.S.C.] Sections 2871-85). Also known as the Military Housing Privatization Initiative (MHPI), this provision of law creates alternative authorities for improvement and construction of military family housing. The legislative intent of Congress in enacting these additional authorities is to enable the military to obtain private sector funding to satisfy family housing requirements. By leveraging available public funding, the Army can obtain private sector funds for construction, maintenance, management, renovation, replacement, rehabilitation, and development of Army family housing and ancillary supporting facilities[1]. The Army's implementation of the MHPI authorities is known as the Army Residential Communities Initiative (RCI).

1.1.2 Fort Belvoir

The Main Post of Fort Belvoir is located in southeastern Fairfax County, Virginia (VA), about 12 miles southwest of Washington, District of Columbia (DC), 10 miles from the Pentagon, and 5 miles from Alexandria, VA. (See Figure 1-1.) The installation also exercises direct responsibility for the Engineer Proving Ground, located about 2 miles northwest of Main Post.

The Main Post lies near the community of Mount Vernon, alongside the Potomac River, Dogue Creek, Gunston Cove, and Pohick Creek, about 85 miles upstream of the Chesapeake Bay. Fort Belvoir's main entrance (Pence Gate) is just off of U.S. Route 1 at Belvoir Road, which is the main thoroughfare through South Post. Route 1 divides the Main Post into areas known as North Post and South Post. Accotink Village, an enclave of privately owned land on the north side of Route 1 across from Tulley Gate, is surrounded on all other sides by Fort Belvoir's North Post.

The Federal government acquired 1,500 acres of land on the Belvoir peninsula in 1910 and it was turned over to the War Department in 1912.The Army began using the Belvoir peninsula in 1915 as a summer training camp and rifle range for engineers stationed at Washington Barracks (now Fort McNair). The installation gained permanent status as Fort A. A. Humphreys in 1922 and was renamed Fort Belvoir in 1935. Until 1988, Fort Belvoir hosted the U.S. Army Engineer School.

Today, Fort Belvoir is the Army's principal administrative and logistics center for the National Capital Region. Fort Belvoir is one of over 20 military installations managed and funded within the Northeast Region Office (NERO) of the Installation Management Agency (IMA). The NERO is headquartered at Fort Monroe, Virginia.

Fort Belvoir is home to two major Army Command Headquarters and elements of 10 others; 19 different agencies of the Army; 8 elements of the U.S. Army Reserve and the Army National Guard; 26 Department of Defense (DoD) agencies; a Marine Corps detachment; a U.S. Air Force activity; and an agency from the Department of the Treasury (Fort Belvoir

[1] According to 10 U.S.C. 2871, the term *ancillary supporting facilities* means "facilities related to military housing units, including facilities to provide or support elementary or secondary education child care centers, day care centers, tot lots, community centers, housing offices, dining facilities, unit offices, and other similar facilities for the support of military housing." However, schools, dining facilities, and unit offices will not be considered as part of the proposed privatization of military family housing at Fort Belvoir evaluated in this EA. For the purposes of this document, *ancillary supporting facilities* also includes housing property management and maintenance facilities that will be operated by the partnership.

Website, 2003). Fort Belvoir supports an installation working population of about 22,200 persons, including about 10,000 civilian employees and 4,400 military service members, as well as about 4,500 military family members living on post (Fort Belvoir Website, April 2003; data current as of October 2002). Fort Belvoir also provides community services to many military retirees living in the greater metropolitan Washington area.

Fort Belvoir provides 2,070 family housing units in 12 distinct housing villages for military families. In addition, Fort Belvoir provides billeting for 808 permanent party enlisted personnel, as well as transient lodging consisting of 491 visiting officer quarters, 23 visiting enlisted and 21 distinguished visitors' quarters (Fort Belvoir Website, April 2003).

Unlike many other Army installations, Fort Belvoir's family housing units are available to permanent party military personnel stationed both at Fort Belvoir and elsewhere in the Washington metropolitan area. It is estimated that 80-90 percent of the military personnel living at Fort Belvoir commute to work at locations throughout the Washington metropolitan area, including Fort Myer, the Pentagon, and numerous office buildings owned or leased by DoD. In this regard, Fort Belvoir is similar to the civilian communities that surround it.

1.2 Purpose of and Need for the Proposed Action

Fort Belvoir has an urgent and immediate need to upgrade the housing provided on the installation for military service members and their families. As the MHPI recognizes, service members and their families deserve to live in housing that is both affordable and of high quality. Service members should not have to live off-post or spend more than their Basic Allowance for Housing (BAH) to obtain good quality housing. The purpose of the proposed action is to improve the quality of the housing stock at Fort Belvoir, by enlarging, modernizing, and redeveloping the housing units; to improve military families' access to improved housing, by avoiding the lengthy turnaround time of the military funding and construction process; and to provide first-rate ancillary supporting facilities.

Current family housing at Fort Belvoir is largely deficient in square footage and configuration for modern families. For many years, funding for housing modernization has been limited, unpredictable, and subject to higher Congressional priorities; as a result, today's soldiers and their families at Fort Belvoir are generally housed in military quarters that are cramped, poorly laid out, and lacking in modern amenities.

Fort Belvoir's problem is also the Army's problem. As the Army's RCI Website <www.rci.army.mil> states, "Under existing budgetary constraints, the Army is unable to address the critical housing needs of America's soldiers and their families." RCI gives the Army and the other military services the tools to address similar housing challenges at a broad range of military installations within the United States.

1.2.1 Inventory and Condition of Fort Belvoir Housing

Fort Belvoir's 2,070 existing military family housing units are located in 12 distinct housing villages. Two of these villages are located on North Post and the remainder on South Post. Fort Belvoir's family housing was built between 1920 and 1980, with 79 percent of the existing homes built before the early 1960s and the remaining 21 percent in 1980. The age

and condition of the military family housing varies from newer units, constructed or substantially renovated within the last two decades, to older units dating back to the early 1920s and mid-1930s.

Architectural surveys at Fort Belvoir have determined that a total of 211 buildings (consisting of 256 single-family, duplex, and townhouse housing units plus 11 garages) in Belvoir Village, Gerber Village, Jadwin, Park and Rossell Villages are eligible for listing on the National Register as contributing elements to the Fort Belvoir Historic District.

According to the housing inventory in the *Army Family Housing Master Plan*, as of 1999, only 219 of Fort Belvoir's 2,070 housing units were rated as "adequate" under the Army's standards of acceptability, based on the condition of major components (i.e., the site and grounds, building exterior, interior workspace, bathrooms, utilities, kitchens, and laundry rooms), and 1,851 units were rated as inadequate," which was defined as units requiring a major repair, component upgrade, component replacement, or total upgrade (DA, 2001). However, since that report was published, 270 homes in Dogue Creek Village have been gutted and rebuilt to provide more space and some of the missing amenities. These rebuilt units provide another 270 adequate housing units for military personnel and family members.

Fort Belvoir's housing has been well maintained and the historic officer housing in Belvoir Village is spacious. However, most of the older units suffer from insufficient floor space, insufficient storage, and poor layout. For example, the size and layout of stairwells and entrances in many Capehart units (George Washington, River, and Colyer Villages) are so narrow that some residents have not been able to get their existing bedroom or living room furniture into the units. From the late 1980s to early 1990s, the Wherry apartments of Lewis Heights (built in 1958) Village were gutted and rebuilt to eliminate one-bedroom units, upgrade kitchens and bathrooms, repaint and replace carpeting. Despite that, based on visual inspection and communication with residents, living conditions in Lewis Heights, which houses Junior Non-Commissioned Officers (JNCOs) and Junior Enlisted service members (JENLs), are still undesirable. One of the problems observed were the damp and moldy basements in some of these buildings, where common storage space is located.

Many of the older units also lack contemporary amenities such as family rooms, laundry/ utility space, adequate exterior storage, and auxiliary eating areas ("eat-in" kitchens, or "breakfast nooks"). Heating and air conditioning is not adequate or efficient in many older units at Fort Belvoir. Although there is no documented backlog of basic maintenance and repair at Fort Belvoir, available funding is not sufficient to comprehensively renovate all the units that need it (RCI, 2002).

Fort Belvoir's waiting list for family housing includes over 400 families and the average waiting time ranges from 1 month for JENLs and JNCOs, up to 24-30 months for Company and Field Grade Officers (Fort Belvoir Website, April 2003-data current as of October 2002). The 2002 *Housing Market Analysis* report found that vacancy rates of suitable rental housing in the defined housing market area are about 3.7 percent, much lower than the national average of 8.4 percent, and that rental costs for adequate housing in the local economy exceed many service members' BAH (Neihaus, 2002). In particular, there is a shortage of acceptable four-bedroom housing units for JNCOs and JENLs. Only 7.3 percent of the rental housing stock in the housing area has 4 or more bedrooms and off-post housing cannot

support the 4-bedroom requirement within affordability standards (Neihaus, 2002; RCI, 2002). Military families must compete with civilian families for affordable housing, which is an increasingly scarce commodity in the metropolitan Washington area.

1.2.2 Goals of the RCI Project

The development entity selected by the Army and Fort Belvoir to form the RCI partnership will be expected to achieve the following goals (US Army, 1998):

- Ensure that eligible military personnel and their families have access to quality, attractive, and affordable housing by either rehabilitating or replacing inadequate existing family housing units.
- Improve the appearance and functions of Fort Belvoir's residential community, while preserving historic properties, protecting cultural resources and meeting environmental stewardship responsibilities.
- Provide ancillary supporting facilities that enhance Fort Belvoir's residential community.
- Maintain positive relations with the communities that surround Fort Belvoir.
- Provide for the effective management and operation of existing, rehabilitated, and new housing units and ancillary supporting facilities on a long-term basis.

1.3 Scope of Analysis

To evaluate the environmental impacts of the proposed action, this EA has been developed in accordance with the National Environmental Policy Act (NEPA), implementing regulations issued by the Council on Environmental Quality (CEQ), and Title 32 Code of Federal Regulations (CFR) Part 651 (32 CFR 651), which was published in the Federal Register on March 29, 2002 (final rule) to revise Army Regulation 200-2, Environmental Effects of Army Actions. The purpose of this EA is to support informed decision-making, to document how the likely environmental consequences of Fort Belvoir's proposed RCI action were assessed and to incorporate input from the public into the decision-making process.

This EA focuses on evaluation of environmental effects that are reasonably foreseeable at the present time, as defined by the "Initial Development Plan" that covers approximately the first 8 years of the implementation of the Community Development Management Plan (CDMP), from the anticipated turnover of housing on December 2003 through 2011. The CDMP is the master agreement ultimately negotiated by and between Fort Belvoir and the private development entity and is described in more detail in Section 2.2.1. During the eight-year period initial development period, FBRC will systematically redevelop or rehabilitate the existing family housing for soldiers and their families on the installation.

Subsequently, the partnership will develop an "Out-Year Development Plan" for ongoing revitalization of all the homes, through the construction of additional amenities and systematic rehabilitation of existing structures, over the full 50-year period that the partnership is expected to operate and maintain those housing units and ancillary supporting facilities. Because specific projects cannot be identified at this time,

environmental effects for years beyond 2011 are not reasonably foreseeable at this time and are not analyzed in this EA. The Army will perform future National Environmental Policy Act of 1969 (NEPA) analysis, as necessary, to address additional actions not addressed by this EA. Follow-on NEPA documentation will be required if conditions change beyond the scope of this EA, whether before or after 2011.

The EA identifies, documents, and evaluates the potential environmental and socioeconomic effects of the proposed action, implementation of the Army RCI at Fort Belvoir through the 8-year period covered by the Initial Development Plan of the CDMP. Section 2.0 describes the proposed action. Section 3.0 sets forth alternatives to the proposed action, including a no action alternative, and explains why certain alternatives are not evaluated in detail. Section 4.0 describes existing environmental conditions at Fort Belvoir that could be affected by the proposed action and identifies potential environmental effects that could occur upon implementation of each of the alternatives evaluated. Section 5.0 presents findings and conclusions regarding the potential environmental effects of the proposed action.

An interdisciplinary team of environmental scientists, biologists, ecologists, geologists, planners, economists, engineers, archaeologists, historians, lawyers, and military technicians has reviewed the proposed action in light of existing conditions and has identified relevant beneficial and adverse effects associated with the action.

The document analyzes direct effects (those caused by the proposed action and occurring at the same time and place) and indirect effects (those caused by the proposed action and occurring later in time or farther removed in distance but still reasonably foreseeable). The potential for cumulative effects is also addressed, and mitigation measures are identified where appropriate.

Consistent with Army and other federal regulations and policies, the Army must undertake numerous other actions to achieve its objectives in implementing the RCI at Fort Belvoir. Figure 1-2 identifies the timeline for the EA process in relationship to other actions that accompany the RCI effort.

1.4 Public Involvement

Fort Belvoir invites public participation in the NEPA process. Consideration of the views and information of all interested persons promotes open communication and enables better decision-making. All agencies, organizations, and members of the public having a potential interest in the proposed action, including minority, low-income, disadvantaged, and Native American groups, are urged to participate in the decision-making process. Guidance for public participation in the NEPA process is provided by 32 CFR 651.

Residents of family housing are key stakeholders for the RCI project. In preparing to privatize family housing, Fort Belvoir has informed military families and solicited their opinions through a variety of means, including regular Town Hall Meetings, biweekly Resident Advisory Committee meetings and monthly Newcomer's Briefings; a survey for residents' input on current housing conditions and RCI information on the Fort Belvoir Website; articles in the Belvoir Eagle; and updates on Fort Belvoir's Command Channel 3 television. In November 2002, Fort Belvoir and Clark Pinnacle invited residents and the

public to a 4-day, on-site Design Charrette, which was intended to involve residents in the conceptual urban and architectural design of their new community. In 2003, the RCI project team distributed a survey to current residents of the historic neighborhoods to solicit their input in establishing a priority list for rehabilitation work to be completed on historic houses. Residents of historic neighborhoods were then invited to an intake session on April 23, 2003, to view and help refine rehabilitation plans.

In September 2002, Fort Belvoir initiated scoping for the proposed action by correspondence with various regulatory agencies. In December 2002 and March 2003, Fort Belvoir invited representatives of interested regulatory agencies to attend meetings in which the proposed action was discussed. Coordination with these agencies is ongoing.

On January 16, 2003, Fort Belvoir held a public scoping meeting at Walt Whitman Middle School. The meeting was advertised by press releases, public notices in the Washington Post and Northern Virginia Journal, and letters to the installation's existing NEPA mailing list. At the meeting, the Army provided information about the RCI process, the vision for RCI at Fort Belvoir, the NEPA process and the Master Plan update.

Prior to that meeting, based on a projected requirement for additional housing at Fort Belvoir, several new parcels of land had been tentatively identified for study and possible future development to allow the construction of 998 new homes over and above the current inventory. These parcels and concepts were presented for exchange of ideas at the public and agency scoping meetings. After careful consideration of input received during the public and agency scoping process, the Army has decided to limit its proposed action to replacement and rehabilitation of the current housing stock (see Section 2.0).

Table 1-1 is a summary of concerns and comments expressed by people who attended the January 16, 2003, scoping meeting, with a reference to where these comments are addressed in this EA. Comments that addressed master planning issues beyond the RCI project or are not applicable to the current proposed action will not be addressed by this EA.

TABLE 1-1
Summary of Public Scoping Comments

Comments by Topic	Where Addressed in EA
Environmental impacts overall and commitment to environmental stewardship (6)	Throughout
Retain baseball fields on Pole Road, maintain long-term relationship between Fort Belvoir and Woodlawn Little League (3)	Section 2.2.1.3 (Development Strategy for Existing and New Housing Villages) and 4.9.2.4 (Quality of Life)
Increasing traffic, mitigation measures for impact to off-post roads, associated air quality impact (6)	Section 4.10 Transportation, Section 4.3 Air Quality
Collect seasonal traffic data	Not applicable to the current proposed action (no appreciable population increase)
Need a public east-west connector road crossing North Post (Route 1 to Telegraph Road) and other local transportation improvements (3)	Not applicable to the current proposed action. See Master Plan EIS (expected in 2004).

TABLE 1-1
Summary of Public Scoping Comments

Comments by Topic	Where Addressed in EA
Ultimate residential and nonresidential population of Fort Belvoir, impact on county sewage treatment plants and schools, both on-post and off-post; start planning to add another elementary school (8)	Not applicable to the current proposed action (no appreciable population increase). See Master Plan EIS (expected in 2004)
Support this project if it will improve living conditions (4)	Section 2.0 Proposed Action
Rossell Village should be demolished to improve living standards	Section 2.2.1.3 Development Strategy for Existing and New Housing Villages
Homes details: hardwood floors are impractical, need more storage	Details of housing design have been coordinated with family housing residents
Potential museum locations near Route 1 vs. potential housing areas (2)	Not applicable to the current proposed action (proposed parcel near Route 1 eliminated)
Access to remains of Belvoir Mansion	Section 4.8 Cultural Resources (public access will be maintained)
Environmental impact statement vs. environmental assessment, cumulative impacts (3)	Section 2.0 Proposed Action and Section 4.13. See also Master Plan EIS (expected in 2004)
Relationship between the NEPA process for RCI and updating the Master Plan (2)	Section 2.0 Proposed Action
Chesapeake Bay Act rules, Chesapeake Bay watershed impacts, impacts on streams (4)	Section 4.6 Water Resources
Consider regional context, clearing land in natural areas around Huntley Meadows and refuges (3)	Not applicable to the current proposed action (proposed undeveloped parcel near Huntley Meadows eliminated)
Homes for enlisted vs. officers, priority for those working on Fort Belvoir (reduce traffic)	Section 2.0 Proposed Action
Reuse building materials after demolition	Section 2.0 Proposed Action
Phasing and relocation of people (living in units to be demolished) off-post	Section 2.1 Residents are encouraged to contact RCI Office with questions.
Consider alternative of building on Engineer Proving Ground or off-post housing (2)	Section 3.0 Alternatives for off-post housing and siting considerations.
Need to brief neighboring communities (2)	See RCI point of contact below to request informational briefing.
Lifetime of new housing should be greater than 50 years	With continuous upgrading, new housing is expected to last longer than 50 years.
Public participation in ongoing Section 106 process (3)	Section 4.8 Cultural Resources
Request for status as consulting parties under Section 106 (3)	Section 4.8 Cultural Resources
Adverse impact, mitigation for demolishing T-400 (1920s wood-frame) houses (3)	Section 4.8 Cultural Resources and 4.13 Mitigation
Adverse impact, mitigation for demolishing T-400 (1920s wooden) houses (3)	Section 4.8 Cultural Resources and 4.13 Mitigation

TABLE 1-1
Summary of Public Scoping Comments

Comments by Topic	Where Addressed in EA
Should preserve some units in Rossell Village for continuity (1)	Section 4.8 Cultural Resources
Impact to integrity on-post historic district; compatible design should differentiate between new and historic housing (2)	Section 4.8 Cultural Resources
Impact to off-post resources: Woodlawn Historic District, Grist Mill, Woodlawn Friends Meeting (2)	Section 4.8 Cultural Resources

The January 16, 2003, scoping meeting also began the public participation process under Section 106 of the National Historic Preservation Act (NHPA), serving to identify interested parties and begin the dialogue. On March 12, 2003, Fort Belvoir invited interested members of the public and other stakeholders to a meeting, to provide more detailed information and receive comments about effects on historic properties. A second meeting was held on May 13, 2003, to provide additional details and receive further comments. Only six individuals who were interested in historic properties attended the May 13 meeting, so they were able to have one-on-one conversations about the proposed action with Fort Belvoir and RCI representatives.

If an EA concludes that the proposed action would not result in significant environmental effects, the Army may issue a draft Finding of No Significant Impact (FONSI). The Army will observe a 30-day period during which time agencies and the public may submit comments on the proposed action, the EA, or the draft FONSI. Upon consideration of any comments received from the public or agencies during this 30-day comment period, the Army may approve the FONSI and implement the proposed action. If, however, during the development of the EA it is determined that significant effects would be likely, then the Army would issue a Notice of Intent (NOI) to prepare an Environmental Impact Statement (EIS).

Public notice of the availability of the EA and draft FONSI for a 30-day review period will be made by advertisements published in local newspapers such as the Washington Post, Northern Virginia Journal and the Belvoir Eagle, by notices mailed to a list of interested organizations and individuals (see Section 9.0 Distribution List) and on the installation Website.

The EA and draft FONSI will be made available for public inspection in the John Marshall, Lorton, Sherwood Hall, and Kingstowne Branches of the Fairfax County Public Library; the Fort Belvoir RCI Office; and on the installation web site at <http://www.belvoir.army.mil>. Throughout this process, the public may obtain information on the status and progress of the proposed action and the EA, by contacting Mrs. Wilma Cooke, Fort Belvoir RCI Office.

1.5 Framework for Analysis

A decision on whether to proceed with the proposed action rests on numerous factors, such as Fort Belvoir's mission requirements, schedule, availability of funding and environmental considerations. In addressing environmental considerations, the Army is guided by several relevant statutes (and implementing regulations) and Executive Orders that establish standards and provide guidance on environmental and natural resources management and planning.

These include, but are not limited to: Clean Air Act (CAA), Clean Water Act (CWA), Chesapeake Bay Act and Chesapeake Bay Agreement, Noise Control Act, Endangered Species Act, Migratory Bird Treaty, Farmland Protection Policy Act, National Historic Preservation Act, Archaeological Resources Protection Act, Resource Conservation and Recovery Act (RCRA), Toxic Substances Control Act, Federal Insecticide Fungicide and Rodenticide Act, Sikes Act, Executive Order 11988 (Floodplain Management), Executive Order 11990 (Protection of Wetlands), Executive Order 12088 (Federal Compliance with Pollution Control Standards), Executive Order 13148 (Greening The Government),Executive Order 12898 (Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations), and Executive Order 13045 (Protection of Children from Environmental Health Risks and Safety Risks). Where useful to better understanding, key provisions of these statutes and Executive Orders are described in more detail in the text of the EA.

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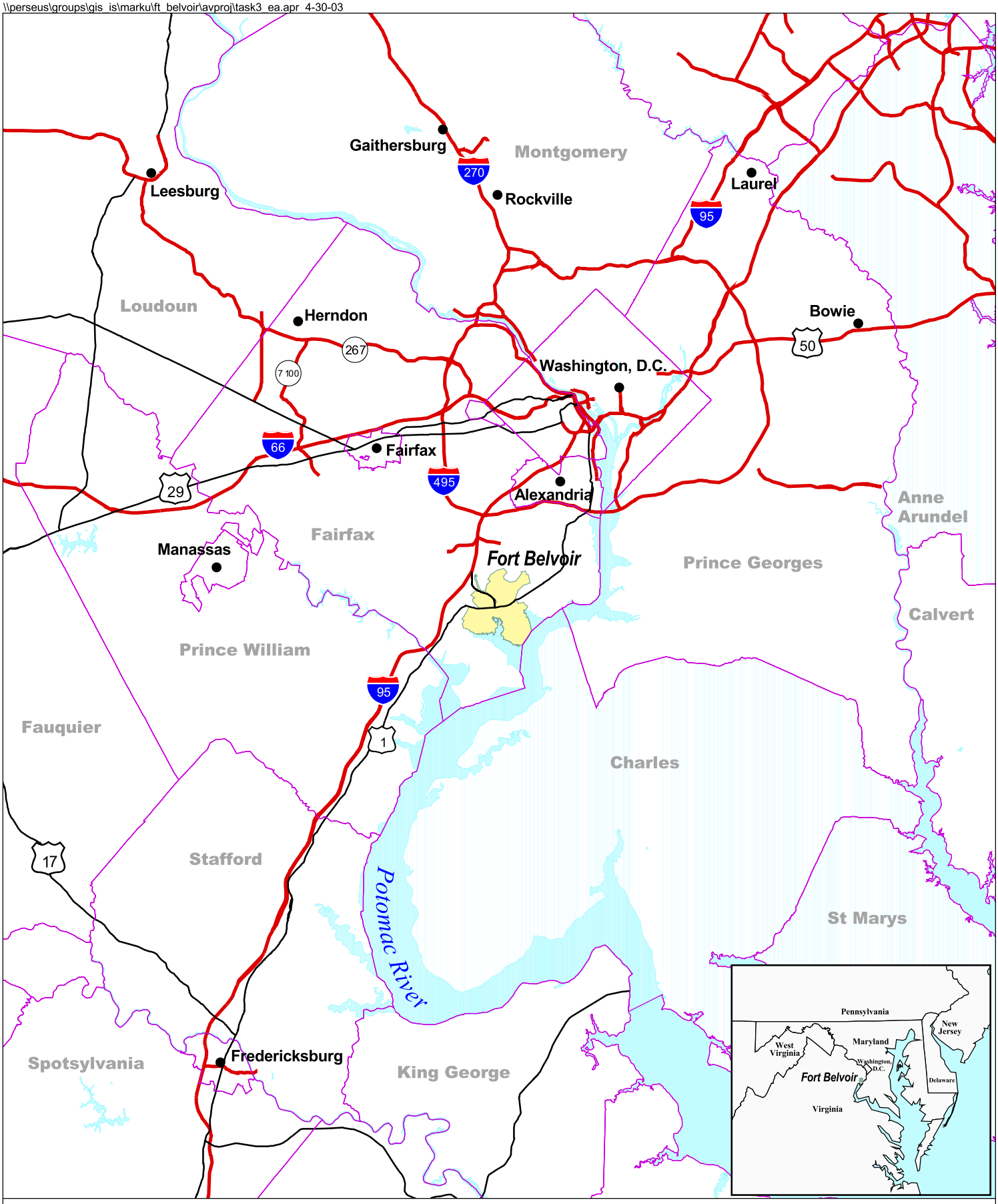


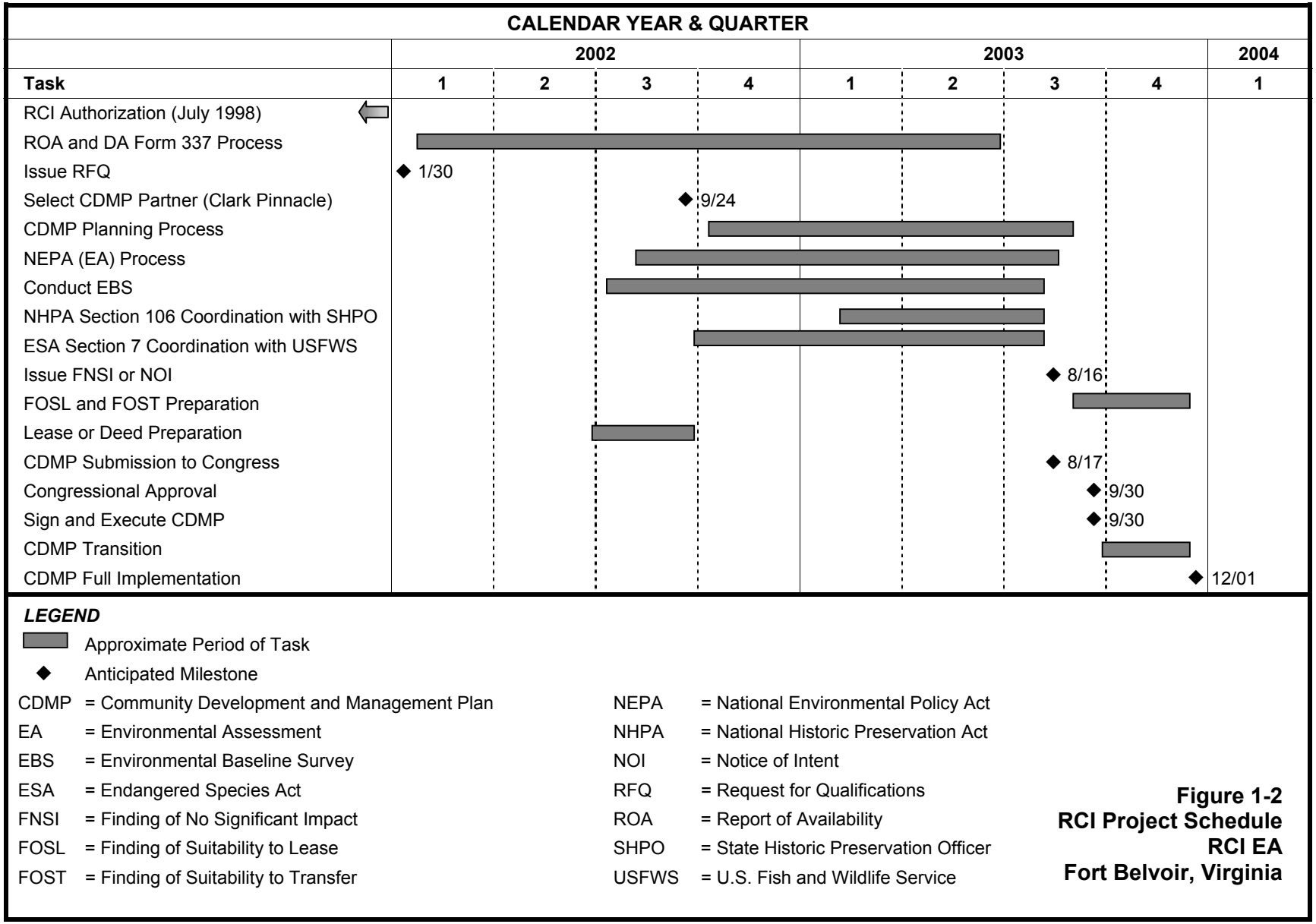
City / County Boundaries
Major Roads
Fort Belvoir
Water Bodies

N

0 4 8 12 16 20 Miles

Figure 1-1
Installation Location
RCI EA
Fort Belvoir, Virginia

CH2MHILL



LEGEND

Approximate Period of Task

◆ Anticipated Milestone

CDMP = Community Development and Management Plan
EA = Environmental Assessment
EBS = Environmental Baseline Survey
ESA = Endangered Species Act
FNSI = Finding of No Significant Impact
FOSL = Finding of Suitability to Lease
FOST = Finding of Suitability to Transfer
NEPA = National Environmental Policy Act
NHPA = National Historic Preservation Act
NOI = Notice of Intent
RFQ = Request for Qualifications
ROA = Report of Availability
SHPO = State Historic Preservation Officer
USFWS = U.S. Fish and Wildlife Service

Figure 1-2
RCI Project Schedule
RCI EA
Fort Belvoir, Virginia

2 Proposed Action

This section presents information on the Army's RCI and Fort Belvoir's proposed action under that initiative. Section 2.1 summarizes the proposed RCI action at Fort Belvoir and describes the Army RCI generally and the legislative authorities in detail, while Section 2.2 describes how the CDMP would be implemented at Fort Belvoir during the initial development period. A summary of the CDMP is provided in Appendix A. Implementation of the proposed action, as described in Section 2.2, is Fort Belvoir's preferred alternative for privatization of family housing. Alternatives are discussed in Section 3.0.

2.1 Residential Communities Initiative

Consistent with MHPI authorities, the Army proposes to transfer responsibility for providing housing and ancillary supporting facilities to a partnership between the Army and a private development entity. This partnership will be known as the Fort Belvoir Residential Communities, LLC (FBRC), a limited liability company. As its private sector partner, Fort Belvoir has selected Clark Pinnacle Family Communities, which is a joint venture between Clark Realty Capital, LLC, and Pinnacle Realty Management Company that was formed to develop and manage military housing. Fort Belvoir is working with its selected RCI partner to develop the CDMP that will implement the MHPI at Fort Belvoir. Development of the CDMP is an iterative process that is fine-tuned to meet Fort Belvoir's needs for attaining affordable, quality housing and other facilities as well as reducing any potential environmental impacts. A summary of the CDMP is provided in Appendix A.

Implementation of the CDMP would require FBRC to operate and maintain all family housing for a period of 50 years, as well as to construct, operate, and maintain ancillary supporting facilities. FBRC will systematically redevelop (demolish and replace) or rehabilitate all existing family housing for soldiers and their families on the installation.

Historic homes that are economically feasible for rehabilitation to meet RCI requirements for modern family housing will be rehabilitated (and some others will be rehabilitated to preserve examples of building types), but some historic housing will be demolished. Actions affecting historic family housing will be undertaken in accordance with an agreement document being developed with the Virginia State Historic Preservation Officer (SHPO) and other consulting parties.

In accordance with the CDMP, the Army proposes to convey to FBRC all 2,070 existing family housing units, located on 548 acres, along with selected parcels of previously disturbed land (82 acres) for construction of "swing space" housing and a recreation center. Fort Belvoir also will make additional disturbed land and existing buildings available to FBRC for temporary construction support and long-term property management facilities. Upon completion of redevelopment and rehabilitation, the total number of family housing units will not differ from the current inventory of 2,070 units. (Details are provided in Section 2.2.)

Specifically, the Army proposes to:

- Convey 2,070 existing family housing units and 11 detached garages in twelve existing villages to FBRC, to be either rehabilitated or demolished and replaced. Upon transfer, FBRC will assume responsibility for all family housing operations at Fort Belvoir. Of the 211 buildings in the housing villages that are eligible for listing on the National Register of Historic Places, 73.5 percent will be rehabilitated and 26.5 percent will be demolished and replaced. All of the other housing buildings will be demolished and replaced, except for 270 recently renovated housing units in Dogue Creek (see Sections 2.2.1.3 and 4.8).
- Provide FBRC with a 50-year land lease of the land underlying these housing villages, which totals approximately 548 acres[2] and is 85.5 percent of the land area defined for troop and family housing use by the 1993 Master Plan. At the Army's option, the term of the ground lease could be extended for an additional 25 years.
- Provide a 50-year land lease, which could be extended by another 25 years, for two additional parcels of land (approximately 77 acres and 5 acres) as described below, all or part of which had been previously developed but are currently vacant, to construct new family housing units and ancillary supporting facilities.
- The total acreage to be leased in all of these parcels would be approximately 630 acres. Figure 2-1 (Site Plan) shows the location of all the current and future housing villages and Figures 2-2 through 2-14, at the end of Section 2.0, depict the conceptual designs for the individual villages.
- The 77-acre parcel in the interior of the South Post, bounded by the South Post golf course on the north, Gunston Road on the west, Belvoir Road on the east and partially by 12th Street on the south, is currently designated for community facilities, industrial and outdoor recreation use in the 1993 Master Plan. The new village to be built on this parcel is referred to as "New South Post Village" in this EA.
- New South Post Village will be used as "swing space" during the rehabilitation and redevelopment process. This parcel will be developed first, to allow families in existing housing to move into new housing while reconstruction or rehabilitation work occurs in existing housing areas. The process of moving families from existing to new or rehabilitated housing through the use of "swing space" will be progressive and will occur over a period of several years.
- Four existing non-housing buildings (1001, 1021, 1022 and 1029) on this parcel would be transferred for demolition. The Comcast satellite dishes (at Building 1029) currently located on the industrial-use portion of the parcel would either be relocated or replaced by underground cable, which is yet to be determined by Comcast and the installation.
- As part of the development of New South Post Village, a new community recreation center will be built on a 5-acre parcel adjacent to New South Post Village, across 12th Street from the Belvoir Chapel.

[2] Exact boundaries and acreage of the RCI parcels to be leased will be determined by a survey of metes and bounds. As discussed in later sections, currently undeveloped portions of some of these study parcels that are not needed for future housing or ancillary facilities are expected to be removed from the parcels to be transferred by the metes and bounds survey.

- In addition, Fort Belvoir will make approximately 26 acres of previously disturbed land and several existing buildings (766, 1126, 1144 and 1436) available by lease to FBRC for long-term property maintenance and property management office space, as well as for short-term construction assembly, staging and equipment storage areas (see Figure 2-1). However, these facilities and land areas will not be included in the 50-year ground lease and may be reclaimed for another use by the installation in the future.
- Existing family housing inventory at Fort Belvoir is 2,070 units. During the initial development period as evaluated in this EA, implementation of the CDMP would include demolishing approximately 1,630 units, constructing approximately 1,630 new units, rehabilitating approximately 170 historic units, and maintaining 270 recently renovated units in Dogue Creek Village, to provide an end state inventory of about 2,070 units; revising the mix of family housing to better meet current military family requirements; addressing the housing deficit of 4-bedroom units; providing garages and other amenities; and improving the landscaping, parks, and playgrounds within the villages.

Although the housing inventory will not increase, the additional land (New South Post Village) is needed as part of the project not only for "swing space" housing but also because, after redevelopment, some of the villages will contain fewer housing units than the existing villages do. New homes will be larger and consist of a mix of detached houses, townhouses and duplexes; there will be no apartment-style buildings. Redeveloped villages will have additional common-use green spaces, in keeping with new urbanism concepts, and stormwater management facilities where existing villages do not provide those, as well as new community centers in some neighborhoods.

The strategy for Fort Belvoir's historic neighborhoods is to retain and rehabilitate all housing from the 1930s Colonial Revival Plan for the development of Fort Belvoir; to retain and rehabilitate examples of the 1920s wood-frame "temporary" housing; and to remove the remaining 1920s housing and the 1940s housing in Rossell Village, in order to allow redevelopment of housing villages within the limited land areas currently available. Of the 211 historic buildings (256 housing units and 11 garages), 155 buildings (144 housing units and 11 garages) in Belvoir, Gerber, Park, and Jadwin Villages will be retained and rehabilitated, while 56 buildings (86 housing units) in Rossell, Park, and Jadwin Villages will be demolished. In all, 73.5 percent of the historic buildings will be retained and rehabilitated, while 26.5 percent of the historic buildings (those that have been determined to be economically or physically unsuitable for rehabilitation, based on their condition and siting constraints) will be demolished.

Demolition and alteration of historic buildings and appropriate mitigation measures will be performed in accordance with a Programmatic Agreement concerning treatment of historic properties that is being developed with the Virginia SHPO and other consulting parties. (Details are provided in section 2.2.1.3, Section 4.8 and Appendix F.)

The Initial Development Plan of the CDMP would be implemented over an 8-year period beginning after notice to proceed is received in fall 2003. The FBRC partnership is expected to assume ownership of existing housing in December 2003. Construction of "swing space" housing on the vacant 77-acre parcel is expected to begin in the first quarter of calendar year 2004. New housing units would be constructed on the vacant parcel before the existing occupied housing units are demolished or rehabilitated, to provide a pool of "swing space"

housing that would prevent a housing shortage during construction and rehabilitation. Some families would have to move as a result of construction and rehabilitation activities, but moving families off-post is not expected. The RCI project will cover expenses of on-post moves, if any, that are required by the RCI project (Bromelkamp, personal communication, May 2003).

Current housing market studies (Neihaus, 2002) reveal that additional family housing for soldiers and their families over and above the current inventory is needed at Fort Belvoir. In this connection, several new parcels of land were tentatively identified for study and possible future development. After careful consideration of input received during the public and agency scoping process; however, the Army has decided to limit its proposed action to replacement and rehabilitation of the current housing stock at Fort Belvoir.

Therefore, this EA will only evaluate parcels corresponding to those designated for family housing under the current (1993) Fort Belvoir Real Property Master Plan and that currently contain housing villages (with some of the parcels expanded slightly to facilitate improved layout of those villages), the "swing space" parcel and recreation center parcel identified above, and the disturbed land and existing buildings to be used for construction support facilities, housing maintenance and offices. The land identified for potential additional housing at the public scoping session held in January 2003 is no longer part of the proposal. The current proposed action provides sufficient land for the Fort Belvoir RCI partnership to maintain and upgrade the current housing inventory and to meet the essential goals of the RCI project, as described in Section 1.2.2.

As part of the process of updating the Master Plan, the Army and Fort Belvoir will continue to attempt to identify additional land that could potentially be transferred to the RCI partnership for building additional housing, up to the levels identified by the then-current housing market analysis. Any parcels of land deemed suitable for additional housing will be designated as such in the updated Real Property Master Plan. Depending upon the availability of new parcels, the Fort Belvoir RCI partnership will consider the commercial feasibility of constructing additional housing on Fort Belvoir, environmental commitments made by the Army and Fort Belvoir and other relevant information, before determining whether or not to construct any additional housing.

Fort Belvoir and the Army will await the updated Master Plan and the Master Plan EIS, which are due to be completed in 2004, and will perform any additional site-specific NEPA analysis as may be appropriate, before making any decisions on transfer of any additional parcels (newly-designated for future family housing by the updated Master Plan) to the Fort Belvoir RCI partnership for development of additional housing.

2.1.1 Army RCI Procedures

The MHPI grants DoD and the Military Services new authorities for obtaining family housing and ancillary supporting facilities. The essence of the authorities is that they comprehensively allow access to private sector financial and management resources for the improvement, construction, operation, and maintenance of family housing. The Army is implementing the MHPI through its RCI program. The Army intends to put RCI into effect at individual installations or, in some instances, at clusters of installations that are in close proximity to each other.

The goal of the Army RCI, simply stated, is to provide affordable, quality housing for military families. Implementation of an RCI project, however, is complex. Projects typically involve large numbers of family housing units and they represent sizable financial stakes for both the private sector developer and the Army. Moreover, project implementation is complex because of the considerable amount of planning, coordination, and oversight that must occur among diverse functions such as engineering, finance, real estate, housing management, law, and others, including the local community.

An RCI project normally addresses an installation's entire inventory of family housing. It might also address required ancillary supporting facilities such as community centers, neighborhood playgrounds, housing offices, and maintenance facilities. An RCI project typically has eight major steps:

1. Decision to Participate in the Army RCI. The initial decision about whether an installation will participate in the Army RCI rests with the Installation Commander. The Commander's decision can be influenced by many considerations. These extend to matters such as the general condition and availability of family housing for military personnel assigned to the installation, the number of personnel on waiting lists for family housing, the length of time required to obtain family housing, and private sector housing costs near the installation. A Commander's decision to participate in the initiative does not necessarily mean that an RCI project will ultimately occur; rather, it means that planning for the project may proceed.

2. Preliminary Determination of Requirements. An RCI project has five very visible components: (1) construction of new housing, (2) demolition of existing housing that is obsolete or beyond economical repair or rehabilitation, (3) renovation of housing, (4) provision of ancillary supporting facilities, and (5) operation and maintenance of the housing inventory. Upon an installation's entry into the Army RCI, information to support decisions about requirements for each component must be gathered and verified. Also, suitable locations may have to be identified for siting of new housing or ancillary supporting facilities.

To help reach these preliminary determinations, the Installation Commander initiates several studies and reports. Among these are a Report of Availability (identification of areas that might be leased to a developer/private sector entity, referred to as the Development Entity), an Environmental Baseline Survey (examination of potential contamination at the proposed lease site), and DA Form 337 (identification of buildings and improvements that might be conveyed to the Development Entity as part of the CDMP). The Installation Commander may begin analysis of potential environmental effects at this early stage of the project's planning. Other studies that might also be initiated include a Housing Market Analysis and engineering studies pertaining to utility capacity, soil testing, and boundary delineation. For RCI projects involving housing eligible for listing in the National Register of Historic Places, the Installation Commander will initiate consultation under Section 106 of the National Historic Preservation Act. In all cases, the Installation Commander initiates coordination with local school districts to ensure local officials' ability to plan for and accommodate children's educational needs.

3. Two-Step Request for Qualifications. The Army RCI Project Office, located within Headquarters, Department of the Army, oversees a two-step Request for Qualifications

solicitation (RFQ). Step 1 of the RFQ identifies potential Development Entities who are highly qualified with respect to experience, financial capability, organization (corporate level), past performance, and small business utilization (general history). Offerors meeting these requirements comprise an exclusive competitive range. In Step 2 of the RFQ process, an installation's Development Entity is selected based on its installation-specific preliminary concept, financial return, organizational capabilities, and small business plan. Clark Pinnacle Family Communities was selected as the Development Entity at Fort Belvoir in September 2002.

4. Negotiation of the Community Development and Management Plan (CDMP). Requirements for new construction, demolition, renovation, and ancillary supporting facilities, as well as future operation and maintenance of family housing, are identified and agreed upon through negotiations between an installation and its Development Entity. It is during this planning and negotiating process that a variety of options or alternatives for family housing (e.g., housing sites and housing densities) and ancillary supporting facilities (e.g., types of facilities and possible locations) are considered and some are dismissed for cost, financial, or other reasons. During this time, the NEPA analysis is conducted and coordinated with development of the CDMP. Through this coordination, some potential alternatives are also dismissed because of environmental concerns, while any remaining environmental issues are considered and appropriate mitigation measures identified.

Throughout development of the CDMP, the Army evaluates the Development Entity's approaches to various issues bearing on environmental stewardship. These include matters affecting potential savings with respect to energy conservation, recycling (both during demolition and construction and during later home ownership), natural landscaping and vegetative cover, and similar "smart" building and operational practices. The resulting CDMP contains all the details of the RCI project, including all work to be done, financing arrangements, and schedules.

5. Approval of the CDMP. The Installation Commander submits the negotiated CDMP through command channels to Headquarters, Department of the Army, for concurrence. The CDMP is then submitted to DoD for review, with notification provided to the Congressional committees responsible for MHPI oversight. This process authorizes the installation's access to the Family Housing Improvement Fund, a revolving fund established for the MHPI, as well as the installation's use of the MHPI's authorities as set forth in the negotiated CDMP.

6. Ratification of the CDMP. Based on DoD's approval of the use of statutory authorities and the revolving fund, the Army and the Development Entity sign the CDMP. Analysis of potential environmental effects in accordance with NEPA is completed prior to approving (signing) the CDMP.

7. Implementation of the CDMP. The CDMP is implemented in accordance with its terms.

2.1.2 Legislative Authorities

The scope of an RCI project is determined primarily by analysis of the condition of existing housing and consideration of additional housing requirements to address the installation's deficit of affordable, quality housing. These factors drive the amount of new construction, demolition, and rehabilitation and the number of ancillary supporting facilities needed at an

installation. Negotiation of the CDMP includes selection of the appropriate legislative authorities to support fulfillment of the installation's family housing needs. These provisions give the Army and its Development Entity exceptional flexibility to create successful business arrangements for the benefit of military personnel and their families. The authorities (with their U.S. Code citations) are summarized below.

2.1.2.1 Direct Loans

The Army may make direct loans to persons in the private sector to provide funds for the acquisition or construction of housing suitable for use as military family housing (10 U.S.C. 2873(a)(1)). However, use of this authority is not envisioned at Fort Belvoir.

2.1.2.2 Loan Guarantees

The Army may guarantee a loan to any person in the private sector if the proceeds of the loan are used to acquire or construct housing units suitable for use as military family housing (10 U.S.C. 2873(b)). However, use of this authority is not envisioned at Fort Belvoir.

2.1.2.3 Investment in Nongovernmental Entities

The Army may make investments in nongovernmental entities carrying out projects for the acquisition or construction of housing units suitable for use as military family housing. Such an investment may include a limited partnership interest, a purchase of stock or other equity instruments, a purchase of bonds or other debt instruments, or any combination of such forms of investment (10 U.S.C. 2875(a), (b)). However, use of this authority is not envisioned at Fort Belvoir.

2.1.2.4 Differential Lease Payments

Pursuant to an agreement to lease military family housing, the Army may pay the lessor an amount in addition to the rental payments made by military occupants to encourage the lessor to make the housing available to military service members (10 U.S.C. 2877). However, use of this authority is not envisioned at Fort Belvoir.

2.1.2.5 Conveyance or Lease of Existing Property and Facilities

The Army may convey or lease property or facilities, including ancillary supporting facilities, to private persons for the purposes of using the proceeds to carry out activities under the initiative. (10 U.S.C. 2878)

2.1.2.6 Interim Leases

Pending completion of a project under the initiative, the Army may provide for the interim lease of completed units. The term of the lease may not extend beyond the project's completion date. (10 U.S.C. 2879)

2.1.2.7 Conformity with Similar Local Housing Units

The Army will ensure that the room patterns and floor areas of military family housing units acquired or constructed under the initiative are generally comparable to the room patterns and floor areas of similar housing units in the local housing market area. Space limitations by pay grade on military family housing units provided in other legislation will not apply to housing acquired under the initiative. (10 U.S.C. 2880(a), (b))

2.1.2.8 Ancillary Supporting Facilities

Any project for the acquisition or construction of military family housing under the initiative may include the acquisition or construction of ancillary supporting facilities. (10 U.S.C. 2881)

2.1.2.9 Lease Payments through Pay Allotments

The Army may require military personnel who lease housing acquired or constructed under the initiative to make lease payments by allotments from their pay. (10 U.S.C. 2882(c))

2.2 Implementation of the Proposed Action

The proposed CDMP will include a number of actions to be undertaken by FBRC and Fort Belvoir. This EA focuses on the principal action of the RCI partnership: managing and systematically redeveloping or rehabilitating all existing military family housing (2,070 housing units) on the installation that will occur within the first 8 years (2004 through 2012) of the implementation of the CDMP. This is the period covered by the Initial Development Plan of the CDMP, which will be followed by operation and maintenance and continuous upgrading of all housing units over the 50-year course of the lease. This section presents an overview of this period of the CDMP. A summary of the CDMP is provided in Appendix A.

The CDMP proposes to make improvements in new and existing housing that will "practically integrate human habitat and a healthy natural environment, so that the long-term use and viability of the homes and the overall residential communities will be enhanced and preserved." Guiding principles for the composition of neighborhoods and villages are to:

- Create an enhanced connectivity between housing areas, schools, community, and recreational facilities
- Provide a usable, functional, and integrated open-space network between and throughout all villages
- Provide a "social infrastructure" through the development of community and recreational facilities
- Establish street systems that reduce pedestrian / automobile conflicts
- Design "walk-able" communities and reduce car dependency

Environmental stewardship is a critical component of the strategy for constructing new homes at Fort Belvoir and for operating and maintaining all the homes over the long term. FBRC will provide representatives to the installation's Environmental Quality Control Committee (EQCC).

Site planning will respond to the following environmental principles:

- Housing villages will be designed to respect the existing natural systems of topography, vegetation and drainage. Development on slopes greater than 15 percent will be minimized to reduce erosion and its corresponding effect on water quality. To the maximum extent practicable, riparian areas will be preserved in forest vegetation to

protect water quality and maintain valuable wildlife habitat; natural stream channels will be protected and maintained; and wetlands will be avoided.

- The existing street and utility infrastructure will be re-used where practical. Where the land plan requires, new utility mains will be built in conjunction with the infill roads and tied into the existing mains at street intersections.
- Existing landscape will be preserved to the extent practicable. The new infill neighborhoods are carefully planned to be integrated and placed into their natural surroundings, to use and connect with existing infrastructure and to preserve existing grand trees, where possible. An effort will be made to retain existing trees within the villages. The plan also promotes the planting of new trees and utilizes large shade trees along paved streets to reduce the heat-island effect.
- The landscape will use primarily native plants, shrubs, and trees, and will avoid monocultures, such as the use of single tree species, on a site.
- A stormwater management system will be designed to handle both quantity and quality of storm water runoff, using best management practices to control and disperse stormwater onsite. In some villages, bioretention swales planted with grasses, shrubs, and other wet-soil adaptive species, will serve as a natural stormwater management system and double as wildlife habitat that is integrated into the surrounding neighborhood.
- Best management practices will be employed in the use and conservation of energy and water. New construction will use standard energy-efficient techniques for the walls, roofs, and windows. Rehabilitation work will use energy-efficient components to replace old systems, where appropriate. As villages are rebuilt or rehabilitated, existing furnaces and hot water heaters that currently use fuel oil will be replaced by natural-gas heating systems. Heating and ventilation systems will be installed that have been designed to meet ENERGY STAR® standards.
- Demolished building materials will be recycled to the extent practicable, to minimize disposal in construction debris landfills.
- Community design will reduce the dependency on the car. With houses that front the street, private driveway systems that direct parking in specific areas and public open spaces, the neighborhood becomes a pedestrian-friendly community. Sidewalks, bicycle paths, and nature trails provide opportunity for travel throughout the site without a car. Villages are planned for no more than a 5-minute walk from center to edge, with tot lot and play areas that are planned for a 2-1/2 minute walk from any home, to encourage convenience and pedestrian activity.
- The sense of community will be heightened with improved and linked open spaces, strategic tree locations, trail systems, activity areas and street layouts to enhance the quality of outdoor life. The plan for open spaces has been designed to encourage safe use of parks, village squares, bike/jogging paths, and playgrounds that are integrated with the natural terrain of each village.

- The existing built and nonbuilt landscapes will be accessed and integrated with the new landscapes.

In accordance with Army policy concerning sustainable design and development, the RCI project at Fort Belvoir will be designed to attain a "Gold" rating on the Sustainable Project Rating Tool (SpiRiT). The design and stewardship principles described above and the way the project has sought input from military families, will help the project toward that goal.

SpiRiT is a self-assessing system, used by the Army Corps of Engineers and based on the U.S. Green Building Council's Leadership in Energy and Environmental Design Rating System 2.0™ (LEED 2.0). It provides a checklist, strategies and scores to help Army facilities meet the needs of current and future missions in a sustainable, cost-effective and environmentally friendly manner. Points are earned for sustainable siting, water efficiency, energy efficiency, reducing air emissions, conserving and recycling materials, indoor air quality, engaging stakeholders in the design process, and designing for both current and future uses or reuse.

A "Bronze" rating is the minimum target score in the tool, but the Army expects all current and future RCI projects to get a "Gold" rating. The SpiRiT rating tool is intended to be used throughout the design process, to guide the project towards a sustainable solution, as well as to score and rate the resulting facility when completed. At the conclusion of the RCI project, either the Army's project team or an independent review panel will use SpiRiT to determine the project's rating level.

The RCI project team will incorporate applicable strategies into the planning, design and engineering of family housing neighborhoods. In the categories applicable to housing, FBRC will meet all minimum requirements and will go beyond the minimum requirements in order to achieve the "Gold" rating.

2.2.1 Community Development and Management Plan Provisions

2.2.1.1 Lease of land

Fort Belvoir will grant FBRC a 50-year ground lease of the approximately 548 acres in 12 parcels currently designated and used for family housing. Fort Belvoir also will grant a 50-year ground lease for two additional parcels of approximately 81 acres for siting of new family housing and ancillary supporting facilities to be constructed, operated, and maintained by FBRC. The term of the lease could be extended by another 25 years.

Lease of these parcels will be subject to several conditions imposed by the Army. The lease will be subject to all existing easements, or those subsequently granted, as well as established access routes for roadways and utilities located, or to be located, on the premises.

The ground lease to be granted to the LLC is expected to include clauses such as:

- Requiring FBRC to comply with all applicable Federal, State and local environmental laws and regulations and, insofar as is practicable, with installation environmental plans and policies that are not otherwise based on law or regulation. The Army would have the right to periodically inspect the premises for compliance with environmental, health

and occupational safety laws and regulations, whether or not the Army is responsible for enforcing them.

- Prohibiting FBRC from storing hazardous wastes (above those quantities generated in routine operations) or taking any actions that would cause irreparable injury to the land.

- Prohibiting FBRC from discharging waste or effluent from the premises in such a manner that the discharge would contaminate streams or other bodies of water or otherwise become a public nuisance or violate any applicable water quality standard or permit provision.
- Requiring FBRC to abide by the terms of an agreement document regarding treatment of historic properties that the Army is developing with the Virginia SHPO and other consulting parties.
- Prohibiting FBRC from removing or disturbing, or causing or allowing to be removed or disturbed, any historical, archeological, architectural or other cultural artifacts, relics, remains, or objects of antiquity. In the event such items would be discovered, FBRC would be required to immediately notify the Installation Commander or his designated representative and to make every reasonable effort to protect the site and the material from further disturbance until the Army gives clearance to proceed.
- Requiring FBRC to maintain all soil and water conservation structures and to take appropriate measures to prevent or control soil erosion within the premises. These measures would be addressed in permits (e.g., CWA Section 404) and in Storm Water Pollution Prevention Plans (SWPPP) prepared before ground-disturbing activities begin.
- Prohibiting FBRC from cutting timber, conducting mining operations, removing sand, gravel, or kindred substances from the ground or in any manner substantially changing the contour or condition of the premises, beyond normal construction and development activities as contemplated by the CDMP, except as authorized by the Army.

In recognition of the fact that FBRC will be a private legal entity, the ground lease is expected to provide that FBRC will apply for environmental permits, as appropriate, for FBRC's activities including both the construction and the maintenance and operation of family housing. FBRC will provide the Army with copies of all correspondence with regulatory agencies, all environmental permit applications, and all permits received (personal communication, Gillett and Connor, June-July 2003).

During the transition period (after the CDMP is approved and before turnover of housing), FBRC will develop an Environmental Management Plan (EMP), in consultation with the Fort Belvoir and the Army, as required by the ground lease. The EMP will discuss the environmental aspects of construction and management of the project and will address spill response procedures and reporting requirements. Related plans that may be incorporated into the EMP, or may be developed separately if they are site- or project-specific, include but

are not limited to sediment and erosion control plans, recycling plan, pesticide management plan, and hazardous materials/demolition and abatement plan.

2.2.1.2 Existing Family Housing Areas

Existing family housing at Fort Belvoir is grouped into twelve distinctly identifiable housing areas, which are located throughout the cantonment area of Fort Belvoir and occupy about 465 developed acres. The majority of the housing areas are in the eastern portion of Fort Belvoir's South Post; Lewis Heights Village and Woodlawn Village are in the eastern portion of North Post (Figure 2-1).

Table 2-1 shows the dates of construction of existing housing units, types of buildings and the range of sizes. (See section 2.2.1.3 for a comparison of existing and proposed new housing.)

TABLE 2-1
Existing Family Housing Construction Types and Size

Village	Year Built	Type/Style/Construction	Number of Units	Size (sq ft)
Belvoir	1934-35	Single-family (brick)	59	3,295 – 7,262
Belvoir	1950	Single-family (brick)	2	2,653 – 3,045
Colyer	1950	Wherry multi-family (brick)	24	1,530
Colyer	1960	Capehart rowhouse (brick)	68	1,296
Dogue[1]	1956[2]	5 units/building (brick)	270	1,137 – 1,264
Fairfax	1960	Capehart duplex (brick)	148	1,458
George Washington	1960	Capehart duplex (brick)	244	1,296
Gerber[2]	1933	Single-family (brick)	4	2,237
Gerber	1930-34	Single-family (brick)	60	2,237
Gerber	1939	Duplex (brick)	12	1,548
Jadwin	1920-21	Single-family (frame)	20	1,809 – 2,374
Jadwin	1940	5 units/building (brick)	25	2,541
Lewis Heights	1958	Wherry (4-12 units/building)	428	*(not available)*
Park	1920-21	Single-family (frame)	14	1,809 – 2,252
River	1960	Capehart duplex (brick)	188	1,467
Rossell	1947-48	Duplex (brick)	60	1,849 – 2,089
Woodlawn	1980-81	Duplex/Quadruplex	444	1,452 – 2,073

1. Major renovations 2002-2003

2. Units 500-503 on 23rd Street are located between Gerber and Fairfax Villages. They are grouped with Gerber Village in this EA, because they are similar to the Gerber Village units and are included in the Historic District, while the houses in Fairfax Village are not.

Existing Villages on North Post

A noteworthy feature of the North Post is the Jackson Miles Abbott Wetland Refuge, a large environmental preserve that forms part of a wildlife corridor linked to Fairfax County's Huntley Meadows Park. The North Post also contains extensive community facilities including the Commissary, Post Exchange and Fort Belvoir Elementary School.

Lewis Heights Village

Lewis Heights is located to the north of Route 1. Lewis Heights contains 428 Wherry housing units built in 1958, consisting of brick, garden-style apartment buildings located along Kimbro Loop, Knight Street, and Meeres Road. Buildings are made up of one-, two, three-, and four-bedroom units. Fort Belvoir Elementary School and the North Post Child Development Center are located to the north and northeast of the housing area. The eastern edge of the village is bounded by a wooded area and a drainage feature that runs along the boundary between Fort Belvoir and the historic Woodlawn Plantation. Military housing units and one tot lot in Lewis Village are visible from the Woodlawn Plantation entry drive, parking lot, maintenance road, and from some points of view on the lawn, gardens and the mansion. The most visible elements are the housing gable ends, which are painted white and are visible through the trees and the brightly-colored tot lot. The Alexandria Society of Friends-Religious Society of Friends Meeting House (also known as Woodlawn Meeting House) is located to the southwest of Lewis Heights. Lewis Heights Village is located within the Woodlawn Historic Overlay District established by Fairfax County's zoning ordinance, which was based on several historic resources including Woodlawn Plantation and the Meeting House (see Sections 4.2 Land Use and 4.8 Cultural Resources for discussion).

Woodlawn Village

Woodlawn Village is located to the north of Pole Road and east of the Jackson Miles Abbott Wildlife Refuge. The village is outside the gates of North and South Post, but it is fenced and entrance is controlled. It is made up of 444 two- and four-bedroom housing units in duplex and quadruplex buildings, built in 1980-81. The houses are sited on small courts off of Plantation Drive. There is an open area running through the middle of the village. Woodlawn Village has housing set aside for Navy and Coast Guard personnel assigned in the National Capital Region. The rest of Woodlawn Village, along with the other housing areas on Fort Belvoir, is available to Army personnel assigned in the National Capital Region or to personnel of any military service assigned to Fort Belvoir.

Existing Villages on South Post

South Post contains the administrative core of Fort Belvoir, along with retail and community facilities and Dewitt Army Hospital, and is anchored by the post core, including the Fort Belvoir Historic District. Ten of the existing villages are located on South Post. Some of the villages are convenient to community facilities, while others are relatively isolated from them.

Belvoir Village

Belvoir Village is located in the southeast portion of the post near the Potomac River and consists of 61 units for senior officer housing. Belvoir Village is within Fort Belvoir's Historic District and these houses are eligible for listing on the National Register of Historic Places as contributing elements to the Historic District (see section 4.8). The majority of the houses are located along Belvoir Road, Mason Drive, Woodlawn Drive and Fairfax Drive. These units

were built in 1934-1935 and consist of 59 four- and five-bedroom, brick single family homes. Belvoir Village also includes two smaller brick homes that were built in 1950, isolated from the rest of the village at the bottom of Patrick Road and overlooking the Potomac River. Streets in Belvoir Village are lined with mature trees and most houses back to wooded areas. There is a large open area between Mason and Woodlawn Drives with a tennis court and a playground. The Officers Club is located at the eastern side of Belvoir Village, and is accessed by the housing area's roads, but it is not included in the parcel to be leased to FBRC.

Gerber Village

Gerber Village is located in the middle of the southern portion of the post. The houses are located on Gunston Road, Middleton Road, and 18th, 19th, 20th and 21st Streets. Gerber Village is within Fort Belvoir's Historic District and all of the houses and garages are eligible for listing on the National Register of Historic Places as contributing elements to the Historic District (see Section 4.8). Gerber Village is made up of three types of houses. Sixty of the units are single family, four-bedroom brick homes built between 1931 and 1933. Four three-bedroom, brick houses that were built in 1933-34 are located on 23rd Street between the rest of Gerber Village and Fairfax Village. The remaining 12 units are three-bedroom brick duplexes that were built in 1939. Gerber Village is adjacent to administrative offices and educational buildings to the south and east. North of the village is a swimming pool and a Fire Station. To the west of the village, separated by a thin strip of trees and a fence, is a row of old warehouses.

Fairfax Village

Fairfax Village is located adjacent to and southwest of Belvoir Village. Fairfax Village consists of 148 units of three-bedroom Capehart housing built in 1960. These units are located along Forney Loop, Tower Road, Marshall Road, and Pope Road. Houses on the outer portions of Forney Loop back to woods. The Belvoir and Potomac View Self-Guided Trail starts at the intersection of Marshall Road and Forney Loop. The ruins of the original Belvoir manor house and the Fairfax family cemetery, which are listed on the National Register of Historic Places, are located to the southeast of Fairfax Village. This resource is part of the Fort Belvoir Historic District, but the houses in Fairfax Village are not.

Dogue Creek Village

Dogue Creek Village was built in 1956 and is located on the eastern side of Fort Belvoir along the confluence of Dogue Creek and the Potomac River. The houses are located along Harlow Road, Fenner Road, Maloney Road, and Moyer Road. There are approximately five to seven units in each of the 45 buildings. Each unit originally consisted of two- and three-bedroom units. A three-phase, $15 million renovation of Dogue Creek Village was completed in January 2003. During the renovation, the units were completely remodeled, additional bedrooms and bathrooms are added to the units, kitchens were enlarged, and all appliances were updated. In addition, as each unit was renovated the units were converted from heating oil to natural gas. Twelve of the units have been renovated to meet Americans with Disabilities Act standards. These units are equipped with ramps with railing, widened doorways, lowered kitchen cabinets and counter tops, lowered light switches, and bathrooms installed with hand bars and rails for bath tubs, lowered sinks, and slanted mirrors. Houses on the outer perimeter of Dogue Creek Village back to wooded areas.

River Village

River Village is located north of Dogue Creek Village, adjacent to Fort Belvoir's Dogue Creek Marina, and southwest of Route 235. The village consists of 188 Capehart-era duplex housing units built in 1960. The units are located along Hudson Road, Potomac Loop, Shenandoah Road, York Road, Rappahanock Road, James Road, and Delaware Road. There is a thin line of woods on the northwestern and northeastern edges of the village. There are two playgrounds in the village, but otherwise there is little open space outside of the yards. Dogue Creek can be seen from the homes on the southern side of the village.

George Washington Village

George Washington Village is located east of River Village. The village consists of 244 Capehart-era, three-bedroom units built in the 1960s. The houses are located on Soldier Road, Miller Road, Farmer Road, and Statesman Road. The village is completely surrounded by woods and a few small streams run through the village. There are a few playgrounds in the village and there are small areas of open space within and around the village.

Colyer Village

Colyer Village is one of the smaller villages and is located southeast of George Washington Village. There are two types of housing within Colyer Village. The first type is Capehart-Wherry-era rowhouse buildings built in 1950, 1956, and 1960 that are made up of two- and three-bedroom units on Peterson Loop. There are also four Wherry-era brick apartment-style buildings with multiple units per building. These units have full basements and detached storage sheds behind the units. There is a playground in the middle of the village, but otherwise there is little open space outside of the yards.

Rossell Village

Rossell Village is located in the southeast corner of the post, north of Belvoir Village and southeast of the Parade Ground. This village consists of 30 brick buildings containing 60 three- and four-bedroom duplex units along Fires Place, Rossell Loop, Caldwell Place, Presnell Place, and Lacy Place. The housing units were built in 1947 and 1948, originally as apartment-style buildings that were later converted into duplexes. Rossell Village is not currently included in Fort Belvoir's Historic District, but a survey in 2000 evaluated these buildings and recommended them as eligible for listing on the National Register as contributing elements to an expanded Historic District (see Section 4.8). There is a playground and a basketball court along Rossell Road and areas of open space in the center of Rossell Loop. Wooded areas surround the village. Houses on the southeastern portion of the village back directly to woods and very steep slopes. A few small creeks run up to and through the village.

Jadwin Village

Jadwin Village is located between Dogue Creek Village and Rossell Village in the southeastern corner of the post. Jadwin Village consists of two types of housing units located along 21st Street and Jadwin Loop. Twenty of the units, built in 1920-21, are three- and four-bedroom frame Craftsman-style houses that were originally intended to serve as temporary houses for troops returning from World War I (WWI).

The remaining 25 units were built in 1940 and consist of five brick buildings with five three-bedroom townhouse units in each building. Each unit has a full basement and a detached

garage/storage area behind the unit. In the middle of the village is an open area with a playground and basketball court. The Craftsman-style frame houses along 21st Street are currently included within Fort Belvoir's Historic District. Recent architectural surveys have recommended the other buildings on Jadwin Loop as eligible for listing on the National Register as contributing elements to an expanded Historic District (see Section 4.8).

Park Village

Park Village consists of fourteen 1920-21 frame, Craftsman-style three-bedroom houses along Harrington Drive and Snow Loop, which are very similar to the frame units in Jadwin Loop.

In all, there are 21 wood buildings in Park Village, on part of Jadwin Loop and along 21St Street, which are often collectively referred to as the "T-400 area" or "T-400" buildings (where "T" indicated "temporary" units). There are two building designs represented, the "L" shape and the "T" shape buildings. They originally stretched in a continuous row from the entrance to Rossell Village on 21st Street, around Jadwin Loop and finishing in Park Village. In 1940, the frame houses along the south side of the central green in Jadwin Village were replaced with brick row houses; others were removed over the years. Recent architectural surveys have recommended all of the T-400 buildings in Jadwin and Park Villages as eligible for listing on the National Register as contributing elements to an expanded Historic District (see Section 4.8).

Parcel Proposed for New South Post Village

The "swing housing" parcel proposed for development under the CDMP as New South Post Village is made up of three distinct subparcels. The largest is the northern subparcel, a U-shaped area of currently undeveloped land bounded by the golf course on the north, Gunston Road on the west, 12th Street on the south, and Belvoir Road on the east. The majority of the western third of the subparcel is cleared with well-maintained lawns. The central third of the subparcel is heavily wooded, while the eastern third is lightly wooded and has a walking trail. There are currently four entrances to the northern subparcel: one from 9th Street, one from Gunston Road, and two from 12th Street. Several buildings are located on the northern subparcel: Building 1029 (Comcast satellite dishes and utility building), Building 1021 (storage building for sports field maintenance), and Building 1022 (transformer). The northern subparcel is otherwise undeveloped, with the exception of two small parking areas and walking trails.

The middle subparcel is adjacent to the northern parcel on the southeastern side across 12th Street and is mostly behind the former Barden School at the intersection of 12th Street and Belvoir Road. The north side of the parcel runs from Belvoir Road to Farrel Road. There are currently no structures on this parcel. Access is through Belvoir Road and 12th Street. The southern parcel is south of the former Barden School and extends south along Belvoir to just before 16th Street. Access to this parcel is through Belvoir Road and 12th Street. One structure is located on the southern parcel, Building 1001 (Army Community Services). In addition, a skateboard park and roller skating rink are located on the southern parcel.

Around 1918, the northern subparcel contained what appear to have been warehouses on the western portion and troop barracks on the eastern portion. During World War II (WWII), the central portion was used as a search light training range, while the western

portion contained a motor pool and more troop barracks, which were demolished sometime during the 1970s. The central portion of the northern sub-parcel was cleared in 1918 and some concrete building foundations remain in this area. The eastern portion appears to have been undeveloped since the structures shown there on 1918 drawings were demolished. During the WWII era, the middle subparcel near Barden School was the site of a theater, while Building 1001 on the southern subparcel was a mess hall until it was converted to administrative purposes after the end of the Vietnam War (Environmental Baseline Survey for RCI Properties at Fort Belvoir, May 2003).

2.2.1.3 Development Strategy for Existing and New Housing Villages

Fort Belvoir and its selected RCI partner have considered numerous options in developing the CDMP. These options considered various alternatives to implement the proposed action. During the first 8 years after implementation of the CDMP, FBRC would demolish approximately 1,630 housing units, construct approximately 1,630 new housing units, rehabilitate 170 historic housing units and maintain 270 recently renovated housing units as-is. Implementation of the CDMP would require that FBRC operate and maintain all family housing for a period of 50 years as well as construct, operate, and maintain the ancillary supporting facilities.

The development plan has several sets of options for family housing units:

- Demolition: Most units would be removed completely. Units would be selected and prioritized for demolition based on location, condition, and livability. Selected units will be removed and not replaced, to provide village restructuring opportunities and new amenities.
- Replacement: Most of the demolished units would be replaced as either:
  - Infill/existing: Build replacement-housing unit within an existing housing area.
  - Replacement/vacant land: Build replacement-housing unit on the currently unoccupied "swing space" parcel.
  - Replacement/existing: Build replacement-housing unit on an existing/occupied-housing site.
- Rehabilitation: All the retained historic houses would be rehabilitated and maintained comparably to private-sector rental properties over the life of the program. The interiors of the historic homes will be modified and updated to gain the best functional use of the available interior space, in accordance with the *Secretary of the Interior's Standards for the Treatment of Historic Properties, with Guidelines for Preserving, Rehabilitating, Restoring and Reconstructing Historic Buildings and Guidelines for the Treatment of Cultural Landscapes* (Secretary of the Interior's Treatment Standards) and with the terms of an agreement document with the Virginia SHPO.

With the exception of the 155 historic buildings (170 housing units and 11 garages) that have been determined to be suitable for rehabilitation and the 270 housing units that were recently renovated at Dogue Creek Village, all the existing housing units at Fort Belvoir have exceeded their useful life and cannot offer residents comfortable, functional housing that is comparable with homes in the local housing market. In all, 73.5 percent (155 of 211) of

the historic buildings will be rehabilitated. Two of these historic homes (L-shaped Craftsman-style houses in Park Village) were considered for demolition, but will be retained and rehabilitated to preserve examples of this housing style on Fort Belvoir. Another 56 historic buildings (86 housing units) have been determined to be inappropriate for rehabilitation, based on their condition and siting constraints, and are proposed for demolition.

Changes in Housing Size and Type

During the 8-year period covered by this EA, all of these obsolete houses will be torn down and replaced by new homes with modern features and high-quality materials and amenities that meet or exceed military and market standards. The replacement housing will be a mix of approximately 59 percent detached single-family residences and 41 percent duplexes/townhouses.

New housing units will be larger than current standards for military housing. House sizes will range from 3-bedrooms through 5-bedrooms to accommodate the families' needs. The total number of bedrooms in Fort Belvoir family housing will increase from 6,136 to 7,256 (5,856 bedrooms in the rebuilt 1,630 units, 552 bedrooms in rehabilitated historic homes, and 848 existing bedrooms in Dogue Creek Village).

At the end of the project, 16 percent of housing units would be for officers and 84 percent would be for enlisted (compared to 15 percent and 85 percent currently).

All homes will have separate laundry rooms or laundry closets and generous interior and exterior storage to accommodate the special storage needs of mobile military families. Inadequate storage space is one of the key needs that emerged from interactions with residents during the initial planning process. In most cases, two-car garages will be provided and placed behind the house, to create streetscapes that encourage pedestrian usage while still allowing direct access to the kitchen areas from the garage.

Five percent of the homes have been designed to comply with handicap accessibility requirements under the Uniform Federal Accessibility Standards. These homes will be interspersed throughout each village, with placement in the flatter areas of the site.

The following is an overview of the proposed development strategy for each of the housing villages. The CDMP Development Brief in Appendix A provides additional information.

The project is currently at the conceptual stage of site planning. Field surveys and engineering have yet to be initiated (and cannot be until after the CDMP is approved and funds are authorized) and it is likely that some home sites will need to be removed or rearranged in the final site planning process, to avoid impacts or resolve engineering issues. Therefore, the conceptual site plans illustrated at the end of this section show the maximum ("up to") number of homes (home sites), given the known site constraints, that realistically could be built on each individual parcel (except for Dogue Creek and River Village, which are not planned for redevelopment at this time). This approach allows for a reasonable "worst case" evaluation of potential construction impacts on each parcel.

However, Fort Belvoir's family housing inventory at the end of the initial development period will not exceed 2,070 homes, even though the "up to" numbers in the following new

village descriptions and home sites shown on the conceptual site plans would total more than that. Final site planning will remove excess home sites.

North Post Villages

Lewis Heights Village

All of the current apartment buildings in Lewis Heights will be demolished and up to 300 homes for JNCOs, JENLs and Senior Non-Commissioned Officers (SNCOs) will be constructed in adjacent and distinct areas. The new road structure in Lewis Heights is inspired by the existing road layout and features a radial plan, centered on a neighborhood center within a formal green, lined with attached and detached single-family homes. Two roads radiate out from this central space, creating one linear park in the southeast direction, and one to the northeast, containing a small formal tree-lined space that transition to a large recreation and play space beyond. Oriented toward Woodlawn Plantation, and reflecting the gardens on the other side, another neighborhood green space acts to create a verdant open connection between this important off-post historic resource and the homes of Lewis Heights.

Woodlawn Village

The largest family housing area at Fort Belvoir, Woodlawn Village, will be the setting of up to 410 new homes for JENLs/JNCOs and SNCOs. As in other villages, JNCO and JENL neighborhoods will be distinct but adjacent to SNCOs. Located at the eastern edge of the Jackson Abbott Wetland Refuge, the existing perimeter road will be entirely preserved and will be addressed in the proposed neighborhood plan as an edge that allows all of the residents an access to the fabulous natural views across this preserve.

At Woodlawn Village's center is a large park, serving as a community gathering and recreation space complete with a Neighborhood Center. This space will also provide natural planted areas – bio-swales – for storm water recharge. The residential blocks are designed to link the central park and the perimeter road edge with a series of small parkways. These open roadways will create a continuous visual relationship between these two types of green spaces. Woodlawn Village will be made up of mostly single-family houses, with a series of town homes and duplexes along the village center and some of the parkways, to provide architectural accent and spatial enclosure.

Note: Fort Belvoir currently allows the Woodlawn Little League nonexclusive use of the installation's McNaughton baseball fields located in Woodlawn Village, under a no-cost license issued by USACE. The Army is actively considering transferring this land (approximately 10 acres) to Fairfax County, perhaps in exchange for other County land. In that event, the preliminary siting of roads and housing within Woodlawn Village (Figure 2-10) could be reconfigured somewhat, but would still be within the existing ring road. The housing units shown on the location of the existing baseball fields would be accommodated within the "up to" numbers shown for Woodlawn or other villages (Hesler, personal communication, July 2003).

South Post Villages

Historic designations, steep terrain, drainage swales, wetlands, water views and tree saves are among the many factors, both natural and man-made, that make the villages on the South Post both distinctive and challenging to redevelop. In the past, these factors also

resulted in villages that developed in partial isolation from one another and the community facilities of the Post.

Responding to this legacy and the challenges offered by the sites, the new South Post villages will be linked by an existing roadway network and a common organizational strategy centered on the Village Green and the existing South Post Town Center. Layout of each of the South Post Villages will be oriented towards its view of the natural forested swales, Dogue Creek, or the green spaces of Fort Belvoir's Historic District.

One of the elements that give Fort Belvoir its sense of place and character is the buildings that make up the Fort Belvoir Historic District. The overall vision for utilizing the historic housing resources at Fort Belvoir is to retain all of the units in Belvoir, Gerber and Jadwin Villages that contribute to the original 1930's Colonial Revival Plan for the development of the post. This was the primary development period of the Historic District, and any development within these neighborhoods will be undertaken so as to retain the Colonial Revival character of the Villages. In addition, the most visible row of 1920-21 housing and two houses in Park Village will be retained, as a vestige of Camp Humphreys. Primary public spaces will remain.

Belvoir Village

The senior officer houses in Belvoir Village are contributing buildings to Fort Belvoir's Historic District. All of these houses will be retained and rehabilitated in accordance with the Secretary of the Interior's Treatment Standards and other applicable regulations and guidance, and as stipulated in the agreement document that the Army is developing with the Virginia SHPO and other consulting parties.

These units will require interior rehabilitation, repairing and upgrading mechanical, electrical and plumbing systems, the energy envelope, kitchens, bathrooms and closets. New detached, two-car garages will be added to the side and rear of all housing units in Belvoir Village, which are presently without them, providing both covered parking and storage. Other exterior rehabilitation work will include maintenance on painted surfaces, roofs, masonry and windows, with possible replacement of some windows (see section 4.8.2.2).

Landscaping will be maintained and upgraded on an ongoing basis, consistent with the historic landscape of the Village. The bucolic central green that helps to define the already distinctive character of Belvoir Village will be maintained.

Up to five new, infill homes will be constructed on available home sites at the entry to Belvoir Village, maintaining the original spacing, sitting and character of Belvoir Village. The infill houses will be designed to be compatible with the historic houses in the Village, utilizing similar style, massing and materials, but will still be readily identifiable as different than the historic units (see section 4.8.2.2 for details).

Gerber Village

All of the houses in Gerber Village are part of Fort Belvoir's Historic District and will be retained and rehabilitated in accordance with the Secretary of the Interior's Treatment Standards and other applicable regulations and guidance, and as stipulated in the agreement document being developed among the Army, the Virginia SHPO and other consulting

parties. These units will require interior rehabilitation, repairing and upgrading mechanical, electrical and plumbing systems, the energy envelope, kitchens, bathrooms and closets.

The smaller Gerber Village houses will be enlarged. Additions will be constructed to the rear of the houses, preserving the existing view of the house fronts. New, detached, two-car garages will be added (across the alley) to all units in Gerber Village, or existing garages will be expanded to two-car garages, to provide both covered parking and much-needed storage space. Other exterior rehabilitation work will include maintenance on painted surfaces, roofs, masonry and windows, with possible replacement of some windows.

Up to five new infill housing units will be constructed on available home sites, maintaining the original spacing, siting and character of Gerber Village. The infill houses will be designed to be compatible with the historic houses in the Village, utilizing similar style, massing and materials, but readily identifiable as different than the historic units (see section 4.8.2.2).

Landscaping will be maintained and upgraded on an ongoing basis, consistent with the historic landscape of the Village.

Jadwin Village

The 25 brick row houses and detached garages built in 1939-1940 on the south side of Jadwin Loop will be retained and rehabilitated.

The 1920s frame houses on the north side of Jadwin Loop are proposed for demolition due to their condition and siting (see section 4.8.2.2 for a discussion of demolition). Up to 30 new row houses (six buildings), of a similar scale and style to those built in 1940, will be constructed to replace them. This will "complete the loop" and fulfill the 1930's development concept for Jadwin Loop. Two garage spaces will be provided for each housing unit in detached multi-car garages, similar to the existing 1939 garages. The size and placement of the loop road and village green will be modified slightly, to allow the new buildings to be placed farther from the edge of the cliff than the existing frame houses are.

The intact row of six, "T"-shaped, 1920s Craftsman-style frame houses on 21st Street between Jadwin and Rossell Villages (considered as part of Jadwin Village for the purposes of this document) will be retained and rehabilitated. The aluminum siding on these houses will be replaced to be more in keeping with the original, and some other period details will be restored. The houses will be enlarged, to provide more living and storage space, and similar rehabilitation work to that described for Belvoir and Gerber Villages will be undertaken.

Park Village

It is proposed that two of the L-shaped, 1920s Craftsman-style houses in Park Village will be retained and rehabilitated in the same manner as the T-shaped houses on 21st Street, as examples of a previously-abundant housing type on Fort Belvoir. The other frame T- and L-shaped houses in Park Village will be demolished and replaced.(See Section 4.8.2.2 for a discussion of demolition.) The frame houses that are retained will have the aluminum siding replaced to be more in keeping with the original. Some other period details will be restored.

New replacement housing will be constructed in a compatible craftsman or bungalow style, evocative of the 1920's Camp Humphreys era. By incorporating a small adjacent and

currently vacant lot into the village, the street will be extended into a loop, similar to other Villages in Fort Belvoir.

Fairfax Village

All of the existing housing units in Fairfax Village will be demolished and replaced with new units. New Fairfax Village is designed to provide residences for up to 90 officers and their families and 30 SNCOs and their families. The site plan utilizes the existing roadway network where possible, including a southern connection between Belvoir and Fairfax Villages, enhancing the roadway network to create an inviting village green. A Neighborhood Center serving both villages will be placed at the head of this green, opposite the Belvoir Village connection.

Dogue Creek Village

Because Dogue Creek Village has recently been renovated, the partnership will simply maintain and operate these units throughout the eight-year Initial Development period addressed by this EA and for an undefined period thereafter. Future planning contemplates replacing the 270 units in Dogue Creek Village during the out years, but the details have not yet been determined and are outside the scope of this proposed action.

River Village

By the end of the Initial Development Period, River Village will be depopulated and all of the 188 existing housing units will be abated and demolished, down to the foundations and slabs of the houses. All streets and utilities, including underground and overhead electric lines, and all trees currently on the site will remain. The site will be graded to prevent ponding of water. This parcel of land will continue to be part of FBRC's leased land and will be reserved for possible future housing requirements, which are outside the scope of this proposed action. (Dogue Creek Marina, which is adjacent to River Village, will not be included in the 50-year ground lease to FBRC. Fort Belvoir will continue to operate the Marina.)

George Washington Village

All of the existing housing units in George Washington Village will be demolished and replaced by up to 210 new homes for JENLs, JNCOs and SNCOs. To the extent possible, the new village layout will be reoriented to take advantage of the nearby waterfront. A new George Washington Village Green will provide views of the water. Additional greens, some lined by homes for JNCOs and JENLs, others for SNCOs, will allow more residents to share in views of the Creek.

Colyer Village

New Colyer Village will be composed of up to 80 homes for SNCOs. The new entrance to this village will be created around a neighborhood green with homes fronting along its length. Colyer Village will be designed to follow, where reasonable, the existing road layouts in order to preserve tree canopy and minimize grading. The village provides an intimate community green allowing for tot lots and informal recreation space.

Rossell Village

All of the brick duplexes in Rossell Village are proposed for demolition due to the layout and siting of the buildings and will be replaced with new housing. (See Section 4.8.2.2 for a discussion of demolition.) New Rossell Village will provide up to 75 homes for Company

and Field Grade officers. Rossell Village will be designed to follow as much as possible the existing curvilinear road layouts to retain the village character and to preserve tree canopy and minimize grading. The village will provide several small community greens allowing for tot lots and informal recreation space.

New South Post Village

FBRC will construct a new village, on land that was previously developed at various times in Fort Belvoir's history, but has been largely vacant for many years. The new village will provide "swing" space to accommodate families while existing villages are being rehabilitated or replaced; will provide additional land to replace existing apartments and other multifamily units with a mix of larger, single-family, duplex and townhouses; and will allow the existing villages to be redesigned to add common-use green space, appropriate stormwater management facilities, and community centers.

The 77-acre parcel that Fort Belvoir has identified for this purpose will be developed as one neighborhood that will wrap around an area of existing post-wide community services (including Belvoir Chapel, a child development center, a physical fitness facility and the Post library), to become what the CDMP refers to as the "South Post Village Center."

The first and larger portion of this neighborhood will be bordered by Gunston and Belvoir Roads, the golf course to the north, and 12th Street to the south, and will become the South Post's "Main Street." In keeping with its "in-town" location, where essential services and administrative areas of the Post will be within easy walking distance, this neighborhood will be made up primarily of town homes and duplexes. This area of the New South Post Village will mostly provide housing, in distinct areas, for the families of JENLs, JNCOs and SNCOs.

The town center strategy includes the creation of a "Main Street" along the current 12th Street. The RCI leasing office will be located here, as well as a unique housing type of housing, the live-work unit. Up to 25 live/work units for Company Grade Officers and Senior Enlisted Officers will be located above a ground-floor space that will be available for retail or service opportunities (such as coffee shops, video rental stores, tax preparation services, etc), which will be available for lease as the South Post's Main Street expands. FBRC will work with the Army and Air Force Exchange Service (AAFES), which has first right of refusal for leasing or licensing operations on the installation, to fill these facilities.

To the southeast and across a realigned Belvoir Road, New South Post Village completes the Fort Belvoir core ensemble. Large townhouses for Company Grade and Field Grade Officers will be built along the eastern edge of Belvoir Road, facing the South Post's main recreation green. This neighborhood is designed to integrate the continuing education opportunities provided at the adjacent Barden Education Center and the recreational amenity of the existing Youth Center as it completes the South Post's Main Street.

The New South Post Village will accommodate a total of up to 410 homes, with approximately 80 percent designated for JENLs/JNCOs and SNCOs in one area and around 20 percent designated for Company-Grade and Field Grade Officers, in another.

Ancillary Support Facilities

Welcome Center

A three-story Welcome Center will be located at the corner of 12th Street and Gunston Road, within the proposed New South Post Village. The primary purpose of the Welcome Center is to introduce military service members and their families who are moving to Fort Belvoir to the family housing areas and all the Post facilities, along with a full orientation to their new quarters. The second and third stories will provide office space for FBRC development and property management personnel.

Recreation

On a 5-acre parcel just south of the New South Post Village and across 12th Street from the existing Belvoir Chapel, FBRC will build a new, state-of-the-art Recreation Center for Fort Belvoir residents and other eligible personnel. The new facility it will be built, equipped, and maintained by FBRC, but staffed by Army MWR. It is expected to include features such as:

- Indoor pool
- Fitness center/weight room
- Aerobics rooms
- Basketball courts
- Tennis courts
- Men's & Women's locker rooms
- Meeting/Activity Rooms

In addition, five new Neighborhood Centers will be built within the Lewis Heights, Woodlawn, Fairfax, George Washington and New South Post Villages at Fort Belvoir (see individual figures for those villages). Each Neighborhood Center will include features such as:

- Great room with attached kitchen for meetings/programs
- Breakout /meeting rooms for smaller groups
- Computer learning center
- Property Management Office
- Fitness room
- Tool loaner room
- Self-Help Center

The following new or improved existing outdoor recreational amenities are planned:

- New tot lots (41)
- Small, medium, and large baseball fields (3) and soccer fields (4)
- Tennis courts (8)
- Basketball courts (8)
- Volleyball courts (6)
- Picnic shelters (14)
- Dog parks (2)
- Outdoor fitness courses (2)

These facilities will be located within the village footprints, as shown in the figures at the end of this section, although the type of facility at each location within the footprint is not final. New fitness courses and playing fields will be constructed around existing and new neighborhood and community centers.

In addition, the existing skateboard park and outdoor roller-blade rink that will be removed when Building 1001 is demolished will be replaced behind the new Recreation Center (where the site plan shows basketball courts).

A new baseball field is planned, on the open area to the south of the proposed Recreation Center and existing track, to replace the ballfield that would removed to build the Recreation Center. (This is the only planned recreational facility outside the proposed housing footprint.)

Property Management and Maintenance Space

In addition to the parcels provided in the 50-year ground lease, property management and maintenance operations will occupy about 40,000 square feet of existing indoor space and 20,000 square feet of outdoor space, on a previously disturbed and mostly paved site of approximately 3.5 acres that includes the current RCI Office (Building 766) and attached warehouse space.

Four other buildings (1108, 1126, 1144 and 1436) that are currently used by Dyncorp, Fort Belvoir's post-wide maintenance contractor, will be made available to FBRC for similar use as housing maintenance facilities. These buildings are located in areas currently designated for Supply, Storage and Maintenance land use.

Fort Belvoir will grant a separate lease to FBRC for the use of these buildings and the Building 776 parcel, which would be revocable if the Army has a future need for the buildings or land, instead of transferring them along with the housing units or including them in the 50-year ground lease.

The planned use of these buildings is:

Building 766 (RCI Office building and warehouse): Offices for the FBRC development, construction and neighborhood property management teams. The remaining warehouse space will be used to store maintenance supplies (screens, doors, plumbing parts) and golf carts.

Building 1108 (existing Self-Help Center): This will become the Gardening Self-Help Center for residents, providing plants and tools, and will continue to store lawnmowers (as it does currently), snow removal equipment and (non-hazardous) snow removal supplies. FBRC's landscaping subcontractor may use this building for short-term storage of landscaping supplies and materials during ongoing landscaping projects (but not for pesticide storage).

Building 1126: This building will be converted to become the new Self-Help Center and Loaner Tools area for residents. Small quantities of paint and paint supplies will be stored in HazMat cabinets. This is the only building where hazardous materials will be stored. It also will continue to store appliances, HVAC parts, and appliance parts as it currently does.

Building 1144: This building will be used to store supplies like screens, doors, lumber, sheet-rock and appliances. The building has no heat or A/C, so there will be no storage of

supplies that could be affected by heat or cold. No physical alterations are planned for this NRHP-eligible warehouse building.

Building 1434: This building will be used to store additional supplies not stored in other buildings and will provide overflow space for storage of office records.

Temporary Construction Support Sites

During village rehabilitation, or demolition and reconstruction, construction trailers and routine construction lay-down areas will be located on disturbed areas within each village where work is being done.

In addition, a central location is needed for Clark Realty Builders' (CRB) office trailer compound, which will include parking and interconnected trailers for project management, field supervision and subcontractors. During construction, the fenced and partially paved portion of the 3.5-acre site that includes the current RCI Office (Building 766) will be made available for this purpose (Figure 2-1). This area is currently designated and used for Supply, Storage and Maintenance.

This site will also house the construction lumber storage yard. Pending a cost-benefit analysis, the existing warehouse portion of Building 766 also may house an indoor wall panel assembly operation. The lumberyard will greatly reduce the frequency of lumber supply truck trips to and from the post. The indoor panel assembly operation would allow construction of wall panels in a single location, sheltered from the weather. Completed panels could be stored onsite until needed and transported to the building sites, reducing the number of supply truck trips and the number of carpenters (and their cars) required at each housing construction site.

Other construction support facilities will be located on two previously disturbed, mostly cleared and partially paved, areas of approximately 4 acres at Theote Road and Warren Roads (Figure 2-1). These land areas are currently designated for Outdoor Recreation land use, but are not actively used as such.

The northern half of this site is tentatively proposed will be used (pending a cost-benefit analysis) for a stone crushing operation and a concrete batch plant. The stone crusher site would be used to store broken-up concrete foundations, curbs and gutters and similar construction debris and to recycle it for road-building materials. The stone crusher would operate intermittently as needed, mostly toward the end of the demolition portion of the construction period for each village. The stone crushing operation will reduce the amount of debris that would otherwise go to an off-post construction debris landfill and will reduce truck traffic hauling debris off-post and bringing road-building materials on-post. An onsite concrete plant would further reduce daily truck traffic through the gates of the post.

The southern half of this site will be used for large equipment storage, during periods of inactivity that are not long enough to justify moving equipment off and back onto the post. The area will be fenced and screened with a dirt or stone base.

Fort Belvoir will grant a limited term lease to FBRC for the use of these construction support sites, instead of including them in the 50-year RCI ground lease. They will only be used during the construction phase.

2.2.1.4 Conveyance

All existing family housing units would be conveyed to FBRC. The Army would convey this property with encumbrances, notices, and requirements obligating FBRC to certain actions. As appropriate to each structure or group of structures, the deed would identify the presence of asbestos-containing materials, lead-based paint, and radon. The Army also would identify any easements and rights-of-way that might affect use of the conveyed property. These encumbrances would be in the form of covenants in the deed and would be binding on the transferee, as well as any subsequent successors or assigns. Negotiated terms of transfer or conveyance may require FBRC to maintain the status quo of historic buildings or archeological sites, may impose a requirement for consultation with the Virginia SHPO prior to any actions affecting such resources and, at a minimum, are expected to require FBRC to abide by the terms of an agreement document developed with the Virginia SHPO and other consulting parties.

2.2.1.5 Barrier-Free Design

New family housing and ancillary supporting facilities must adhere to the Uniform Federal Accessibility Standards and the Americans with Disabilities Act Accessibility Guidelines promulgated by the Access Board (formerly known as the Architectural and Transportation Barriers Compliance Board) pursuant to the Architectural Barriers Act of 1968, Rehabilitation Act of 1973, and Americans with Disabilities Act of 1990. These standards require that at least 5 percent of new family housing be designed and built to be accessible, or easily modifiable for access, by persons with physical disabilities.

2.2.1.6 Construction standards

Construction standards to be applied to family housing would be determined during negotiations regarding the CDMP and are expected to conform to local community building codes and standards.

2.2.1.7 Operation and Maintenance

FBRC would operate and maintain for 50 years all existing and new family housing units and ancillary supporting facilities, including associated parking lots and sidewalks, in accordance with quality standards established in the CDMP. At the Army's option, the installation may extend the period of operation and maintenance and the leases of land supporting family housing for an additional 25 years.

2.2.1.8 Rental Rates and Payments

The rental rate to be paid by an individual military personnel would not exceed his or her BAH. Fort Belvoir would continue to categorize family housing by grade group (e.g., JENL, JNCO, Senior Non-Commissioned Officers [SNCO], Company-Grade, etc.).

2.2.1.9 Occupancy Guarantee

The Army will not guarantee FBRC a level of occupancy of the housing units. Under special circumstances such as large-scale long-term deployments, military downsizing or potential post closing, the Garrison Commander and Housing Liaison Officer could authorize expansion of eligibility for vacant family housing units to tenants other than service members with dependents in accordance with the "Priority of Assignment for Family

Housing" that appears in the CDMP and in the ground lease, at rental rates of no less than what an eligible service member would be charged. Under such a circumstance, the order of eligibility for Fort Belvoir military family housing would be:

1. Accompanied military personnel assigned or attached for duty at Fort Belvoir.

2. Accompanied military personnel assigned or attached for duty at other military installations within a 50-mile radius of Fort Belvoir.

3. Unaccompanied family members of military personnel.

4. Unaccompanied military personnel (married and single) assigned or attached for duty at Fort Belvoir.

5. Accompanied retired military personnel and spouses or widowed spouses of retired military personnel.

6. Accompanied DOD and Federal Agency civilians (other than designated Key and Essential personnel.)

7. Non-military personnel, non-DOD personnel and non-federal Agency personnel (general public)

2.2.1.10 Regulatory Controls

It is the intent of the development plan to adopt the International One and Two Family Dwelling Code, 1998 Edition by the International Code Council, Inc. with standardized requirements for Building, Plumbing, Mechanical, and Electrical by incorporation of a compilation of data from the following national model codes: Uniform Building Code; Standard Building Code; Building Officials and Code Administrators International, Inc. (BOCA) National Building Code; Standard Plumbing Code; International Building Code; BOCA National Plumbing Code; Uniform Mechanical Code; Standard Mechanical Code; Standard Gas Code; BOCA National Mechanical Code; Code for the Installation of Heat-Producing Appliances; National Electrical Code; applicable National Fire Protection Association (NFPA) codes and standards; applicable Virginia State Codes and Regulations; and applicable federal codes and regulations. Where codes and standards conflict, federal or national codes would be deemed to prevail.

2.2.1.11 Utilities

FBRC will be responsible for all costs of utilities provided to common areas of the project and all vacant units during the entire project period. Further, FBRC will be responsible for all utilities in occupied housing units covered by the project until the units have been rehabilitated or replaced, utility meters (electric, gas, and/or oil) are installed, and a 12-month consumption record has been established. When these three conditions are met in an entire housing area and appropriate notice is provided to the service member occupant, the service member will become responsible for the cost of utilities for their residence, as described below.

The intent of the Army RCI Utility Policy is to encourage energy conservation by service members. After baseline consumption records have been established, an average utility consumption cost will be determined for each housing unit type. The service member will

then receive this amount from his BAH and be responsible for paying utilities. Should the utility costs exceed the service member's identified utility allowance, the service member will be responsible to pay that amount from basic pay. If the utility bill is less than the calculated allowance, the service member retains those funds. The remainder of the service member's BAH will go to FBRC as rent.

FBRC also may install meters to track usage of water and wastewater at individual housing units or may install a master meter at the village entrance. However, in accordance with Army RCI utility policy, it is expected that these utilities will remain a project-level cost.

2.2.1.12 Police and Fire Protection

Fort Belvoir provides its own police and fire protection on a reimbursable basis in the family housing areas.

2.2.1.13 Jurisdiction

Fort Belvoir historically has been an exclusive federal jurisdiction enclave. This means that only federal laws, or state law assimilated into federal law, have been enforced on the installation. For instance, all prosecutions for crimes under federal law, including crimes assimilated from state law, (e.g., shoplifting in the Post Exchange) occur only in federal court. Fort Belvoir will retain exclusive federal legislative jurisdiction.

2.2.1.14 Implementation Commencement

Assuming negotiation and execution of the CDMP by Fort Belvoir and Clark Pinnacle Family Communities is successful and notice to proceed is issued in September 2003, implementation of the CDMP will begin with turnover of the housing units to the partnership in December 2003. Construction and rehabilitation activities will begin in early 2004, with full build-out anticipated by 2012 (8 years).

2.2.2 Siting of New Housing

Fort Belvoir has recognized the need to provide additional land to improve the current housing inventory, both because "swing space" housing is needed to accommodate families moved out of villages as they are redeveloped and because some of the housing villages will contain fewer homes than before they were redeveloped. There are several reasons for this: multi-family apartment buildings are being replaced with a mix of single-family, townhouse, and duplex homes; common "village green" space will be designed into existing neighborhoods in accordance with new urbanism concepts; storm water facilities are needed to appropriately handle storm water runoff in villages where it is not currently being controlled; and neighborhood centers will be provided for the redeveloped communities.

Evaluation of potential sites for additional family housing at Fort Belvoir resulted in identification of one 77-acre "swing space" parcel meeting the criteria described below. To the extent possible, the following siting criteria have been considered in establishing the footprint for the RCI family housing:

- Proximity to existing housing
- Sufficient size
- Physical features

- Compatible land use
- Minimal loss of natural, ecological, and cultural resources
- Military security

2.2.2.1 Proximity to Existing Housing

New family housing and ancillary supporting facilities would be located near existing family housing. From a land use pattern perspective, this approach allows for maintaining consistency in adjacent land uses in larger general areas. It also results in residents being close to existing supporting facilities such as schools, community clubs, the post exchange, the commissary, and auto service stations. Such proximity helps create a sense of "small town" neighborhoods where principal shopping destinations are nearby. Locating new neighborhoods close to existing ones helps to reduce development costs by enabling use of existing utility corridors and other infrastructure. Finally, keeping family housing in or near a generally developed portion of the installation avoids opening undeveloped and environmentally sensitive areas. Risk of potential effects on ecological systems (e.g., wildlife disturbance, habitat fragmentation) are thus decreased.

The site proposed for the new RCI housing area, New South Post Village, is in the South Post core area, within walking distance of essential community services, including retail outlets, credit union, day care center, library and chapel, as well as many administrative areas of the Post. The Commissary and main Post Exchange are located on North Post, which will require driving.

2.2.2.2 Sufficient Size

Lack of adequate acreage for proposed housing could adversely affect an otherwise pleasing atmosphere by creating too high a building density. Allocation of an adequate amount of property would result in a density that strikes an appropriate balance between the residents' desire for space and an appropriate use of land resources. This criterion also takes into consideration the value of land in a suburban setting. The "swing space" parcel that has been allotted provides sufficient additional space to reconstruct the existing housing inventory with additional amenities, at an acceptable density mix that eliminates apartment-style units.

2.2.2.3 Physical Features

Any new site for family housing must not be located on steep terrain, in areas heavily incised by watercourses, or within any stream buffers, wetland buffers, or floodplains. New South Post Village does not fall below a 100-year floodplain elevation and stream buffers within the parcel are protected by the site design. Approximately one-third of the existing River Village houses, located below elevation 10, are within the existing floodplain based on current FEMA flood elevations. The proposed action is to depopulate and demolish River Village by the end of the initial development period. Floodplains will be an issue of concern for future plans (outside the scope of this action) to redevelop River Village. The site plans avoid building in stream ravines and similar features. (See Section 4.0 for a detailed discussion of physical features and development constraints on the housing village sites.)

2.2.2.4 Compatible Land Use

Family housing parcels must not result in creation of incompatible land uses (e.g., within airfield runway accident potential zones or clear zones, within or near high-noise areas, on contaminated properties, or adjacent to off-post industrial property). None of these factors apply to the proposed New South Post Village in the center of South Post. The site is not within restricted zones for Davison Army Airfield, which is located at the western side of North Post.

2.2.2.5 Minimal Loss of Natural, Ecological, and Cultural Resources

Siting of family housing must minimize the loss of natural, ecological, and cultural resources such as wetlands, listed or sensitive species or their habitat, wildlife species' travel corridors, historic trees of significant value, archaeological sites and structures eligible for listing on the National Register of Historic Places. The potential for loss of sensitive resources has been minimized in selecting the proposed New South Post Village parcel, which was previously developed. (See Section 4.0 for discussions of resources on and near this site.)

2.2.2.6 Military Security

Parcels must be located so as not to enable or encourage residents to interfere with military security requirements or to pose risk of breach of military security. Housing areas should not be located near sites supporting activities to which access is controlled for security reasons. None of these factors apply to the proposed New South Post Village parcel. Force protection requirements for a buffer between parking lots or roads and buildings that hold more than 50 people have been incorporated into the design of the Recreation Center; this requirement does not apply to siting of individual homes.

2.2.2.7 Operational Safety

Parcels should be located away from operational areas to avoid potential safety risks to residents. Parcels for siting of family housing also should not be located so that residents would be required to travel past or through training areas while transiting to off-post locations. None of these factors apply to the proposed New South Post Village parcel.

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95

Fairfax County Pkwy

1

Woodlawn Rd

Woodlawn Village

Lewis Heights Village

River Village

George Washington Village

Colyer Village

Gunston Rd

1436

New South Post Village

Dogue Creek Village

Dogue Creek

1126

1144

1108

776

Park Village

Jadwin Village

Rossell Loop Village

Gerber Village

Belvoir Village

Fairfax Village

Accotink Bay

Pohick Bay

Gunston Cove

Potomac River

Pennsylvania

New Jersey

West Virginia

Maryland

Washington, D.C.

Fort Belvoir

Delaware

Virginia

Property Mgmt and Maintenance Bldgs
Recreation Center
Fort Belvoir Boundary
Roads
Buildings
Streams
Water Bodies
Existing Housing Areas
Proposed New Housing Areas
Construction Support Sites

N

0 1250 2500 3750 5000 6250 7500 Feet

Figure 2-1
Site Map
RCI EA
Fort Belvoir, Virginia

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Road edge of pavement
Buildings
Streams
Water Bodies

N

0 250 500 750 1000 1250 Feet

Figure 2-3
Preliminary Site Plan - Fairfax Village
RCI EA
Fort Belvoir, Virginia

CH2MHILL

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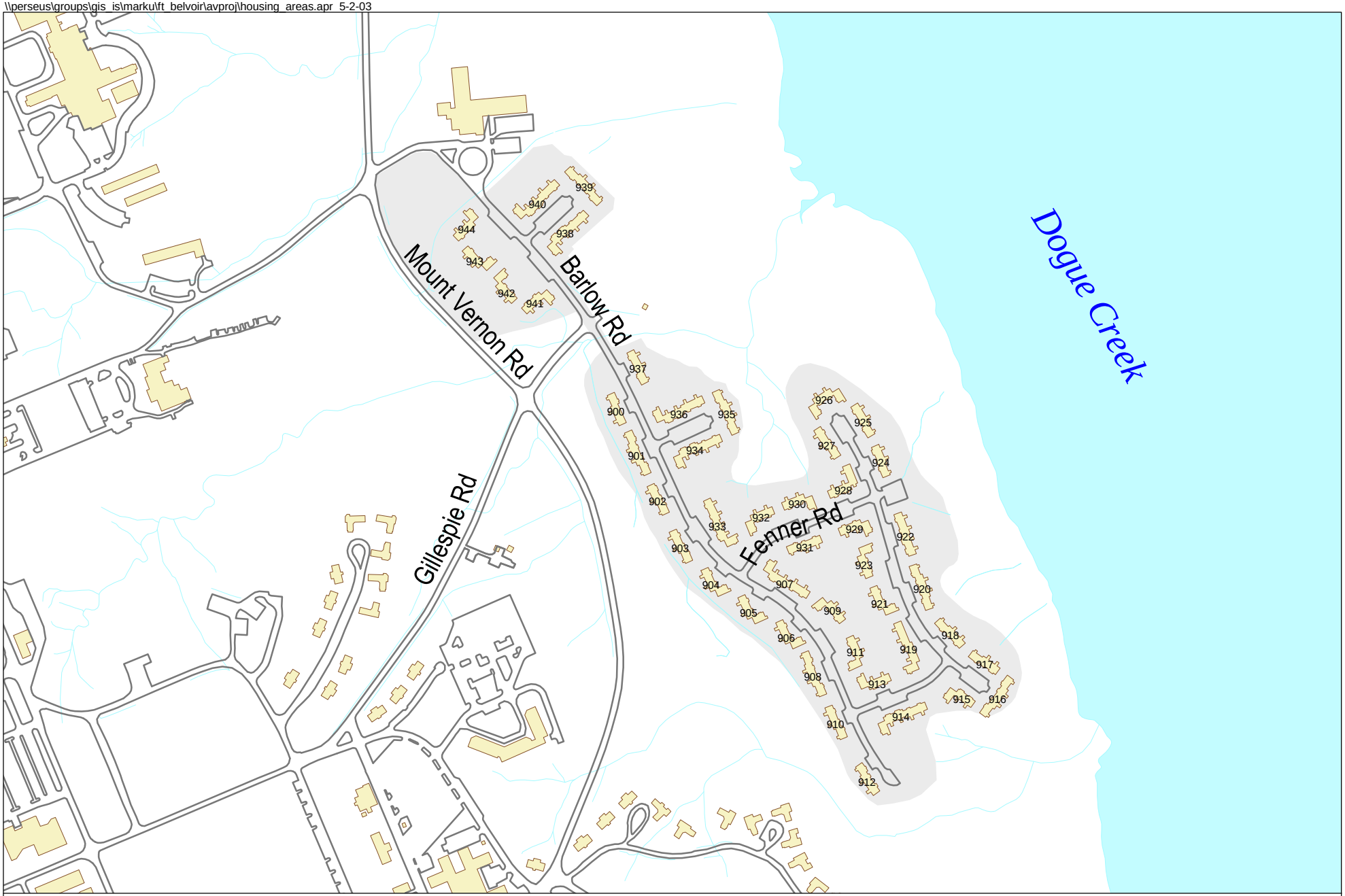

Figure 2-4
Existing Site Layout - Dogue Creek Village
RCI EA
Fort Belvoir, Virginia

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Road edge of pavement
Buildings
Streams

N

0 200 400 600 800 1000 Feet

Figure 2-5
Preliminary Site Plan - Gerber Village
RCI EA
Fort Belvoir, Virginia

CH2MHILL

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Road edge of pavement
Buildings
Streams

N

0 200 400 600 800 1000 Feet

Figure 2-6
Preliminary Site Plan - Lewis Heights Village
RCI EA
Fort Belvoir, Virginia

CH2MHILL

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Figure 2-7
Existing Site Layout - River Village
RCI EA
Fort Belvoir, Virginia

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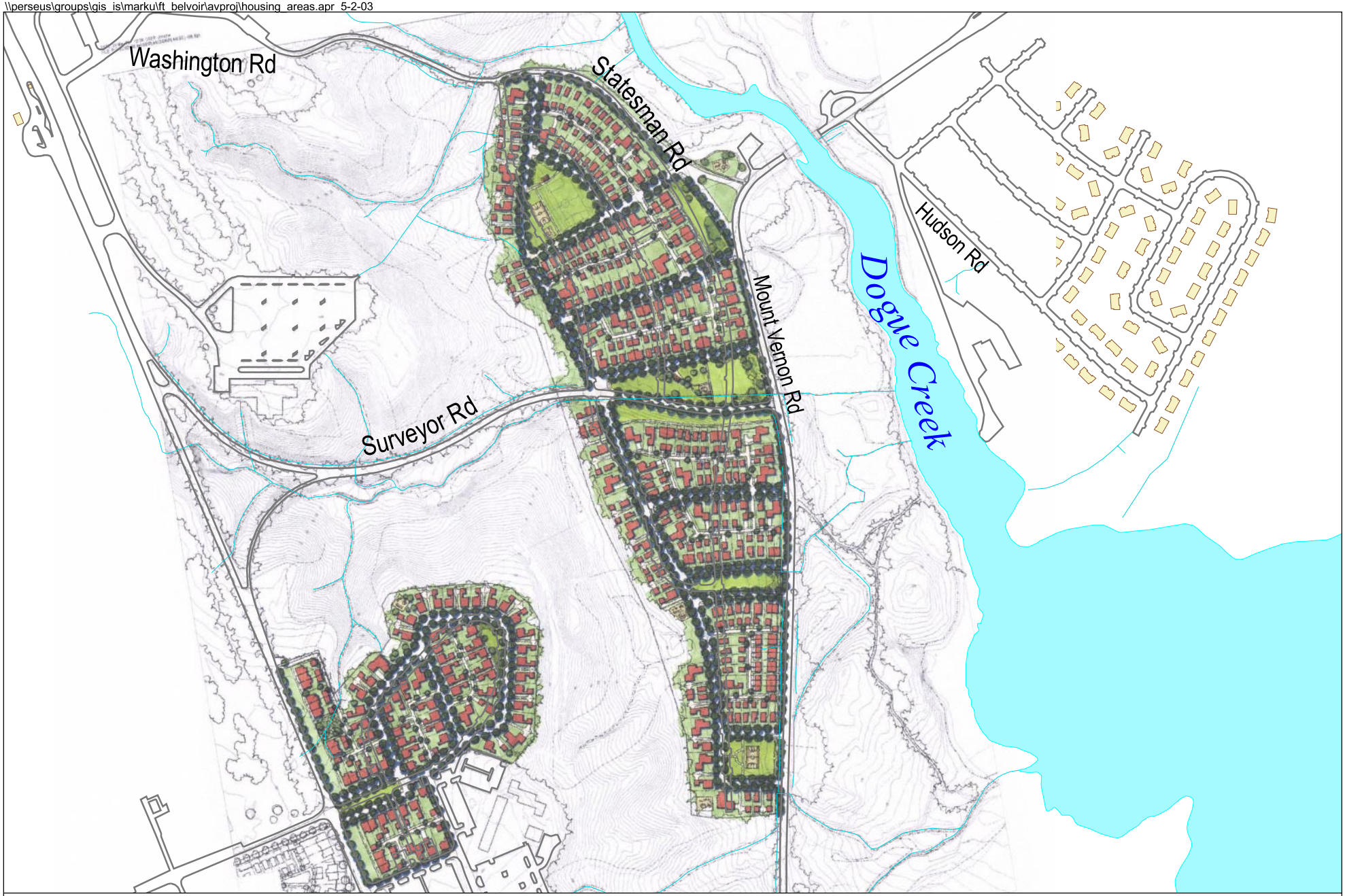

Road edge of pavement
Streams
Water Bodies

N

0 250 500 750 1000 1250 Feet

Figure 2-8
Preliminary Site Plan - George Washington Village
RCI EA
Fort Belvoir, Virginia

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Road edge of pavement
Streams

N

0 150 300 450 600 750 Feet

Figure 2-9
Preliminary Site Plan - Colyer Village
RCI EA
Fort Belvoir, Virginia

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Road edge of pavement
Streams
Water Bodies
Wildlife Corridor

N

0 300 600 900 1200 1500 Feet

Figure 2-10
Preliminary Site Plan - Woodlawn Village
RCI EA
Fort Belvoir, Virginia

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Streams

N

0 100 200 300 400 500 Feet

Figure 2-11
Preliminary Site Plan - Rossell Loop Village
RCI EA
Fort Belvoir, Virginia

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Streams

N

0 150 300 450 600 750 Feet

Figure 2-12
Preliminary Site Plan - Jadwin Loop Village
RCI EA
Fort Belvoir, Virginia

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Streams

N

0 150 300 450 600 750 Feet

Figure 2-13
Preliminary Site Plan - Park Village
RCI EA
Fort Belvoir, Virginia

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Road edge of pavement
Buildings
Streams

N

0 150 300 450 600 750 Feet

Figure 2-14
Preliminary Site Plan - New South Post Village
RCI EA
Fort Belvoir, Virginia

CH2MHILL

3 Alternatives

The Army has identified three alternatives for its proposed RCI action at Fort Belvoir, in addition to a no action alternative. These alternatives are presented below. Two of these three alternatives were considered but not carried forward for analysis in this EA, for the reasons discussed. In addition, this section presents the process that was used to screen the potential sites proposed for "swing space" housing and temporary construction support facilities.

3.1 Preferred Alternative - Privatization

Implementation of the proposed RCI action, as described in Section 2.2, is the Army's preferred alternative. Use of various MHPI authorities, identified in the CDMP, would achieve the purpose of and need for the proposed action as described in Section 1.2.

Implementation of the CDMP will address urgent deficiencies in the condition and configuration of family housing and will improve the quality of life for military service members and their families living on Fort Belvoir. Accordingly, this alternative of privatizing the existing housing inventory at Fort Belvoir is evaluated in detail in Section 4.0 of this document.

3.1.1 Siting

Because of cost, financial, environmental, or other reasons, certain choices such as alternative housing sites, housing densities, housing formats (high-rise vs. low-rise), types of ancillary supporting facilities and timing of specific FBRC actions, were eliminated from further consideration during CDMP negotiations.

The following is a summary of the screening process that was followed to select the parcels proposed for "swing space" housing, a new Recreation Center and temporary construction support facilities.

Land use planning principles at Fort Belvoir include "Smart Growth" principles that include:

- Focusing new development on previously disturbed areas
- Consolidating development to provide opportunities for mass transit and economy in infrastructure improvements
- Conserving land and preserving environmentally sensitive zones and other natural resources of significant value
- Emphasizing pedestrian access in facility siting by locating housing, services and employment centers close together

Selection of the 77-acre parcel for New South Post Village adheres to these principles by siting the new village on land that was disturbed (roughly two-thirds of it) by prior

development and is close to the South Post's community facilities, including the Home and Garden Center, PX gas station, car and truck rentals, credit union, and various retail facilities, as well as the post library, chapels, child development center, field house, hospital and other support activities. Siting the new Recreation Center on the adjacent 5-acre parcel, which was previously disturbed, will provide yet another community facility in this area that residents can walk to.

A parcel near Pence Gate was initially considered for "swing space" but was removed from further consideration in this EA, because it does not provide enough land for the number of housing units that need to be relocated from existing villages and also because it was being considered as a possible site for the Army Museum.

Other parcels on the North Post that were initially considered are closer to the Commissary, PX and Fort Belvoir Elementary School, but had considerably more potential for adverse environmental consequences than the proposed New South Post Village parcel.

The Engineer Proving Ground (EPG), a separate parcel of land located about 2 miles northwest of the Main Post (across I-95) that Fort Belvoir exercises responsibility for, was rejected early in the planning process as an unsuitable location for new housing. EPG is too far away from the employment centers and community services on Main Post, which would be inconvenient for residents, diminish their sense of community, and would require additional force protection measures for their safety and security. Additionally, EPG is not currently available to Fort Belvoir for family housing. If the Department of the Army determines that there is no future operational need for this land, the Army has legislative authority to dispose of EPG in three parcels: the Army may convey about 135 acres to Fairfax County as parkland, may convey about 170 acres to the Commonwealth of Virginia to complete the Fairfax County Parkway, and could sell or dispose of the remaining 515 acres under other conditions.

The temporary construction support sites shown on Figure 2-1 were selected from a number of potential sites, in an iterative screening process that considered environmental concerns, transportation, proximity to Route 1, adjacent operations, proximity to residential areas and the Accotink Bay Wildlife Refuge, historic viewshed, permitting requirements, potential for conflicting future operational needs and the existing infrastructure needed to support the operations.

3.2 Partial Privatization Alternative

Under this alternative, Fort Belvoir would subject only a portion of the installation's family housing to the RCI. Family housing in good condition (not needing demolition or renovation/rehabilitation) would remain subject to Army management for maintenance and operational control.

Privatization of only a portion of Fort Belvoir's family housing inventory would have three substantial drawbacks. First, the condition of the family housing retained by the Army would change over time, resulting in a need for its renovation or replacement and there is no reason to believe that adequate funding would be made available for this work, in view of the history of Army Family Housing funding (RCI, personal communication, May 2003).

Failure to include the entire inventory of housing in the RCI program would only delay action to provide adequate housing for military personnel and their dependents.

Second, two management regimes (the Army's and FBRC's) would not be as cost-efficient as one. Having a single housing program increases opportunities to maximize the cash flow available for construction, maintenance, rehabilitation and operation of the housing and ancillary support facilities desired by the installation. Finally, partial privatization would not fully meet the Army's purpose of and need for the proposed action, as a dual management approach could be perceived as creating inequities among the resident population, which would be counterproductive to the morale-building aspects of RCI.

Together, these factors render consideration of partial privatization at Fort Belvoir not feasible, and therefore such an alternative is not evaluated in detail in this EA.

3.3 Private Sector Reliance Alternative

Under this alternative, the Army would rely solely on the private sector to meet the housing needs of personnel assigned to Fort Belvoir and other service members who are eligible for family housing at Fort Belvoir. The installation would terminate family housing programs at Fort Belvoir, dispose of existing family housing units, and convert the land that now supports housing areas to other uses. This alternative would require approval of the Secretary of the Army.

The alternative is premised, in part, on the view that competitive marketplace forces would lead to the creation of sufficient affordable, quality family housing. Data vary, but in general experience shows that military families living off-post must cover between 15 and 20 percent of their costs out-of-pocket. Moreover, there are several intangible benefits to military personnel and their families living on-post. These include camaraderie and *esprit de corps* among the military personnel, convenient access to military community services, a sense of "family" among dependents (especially during deployments), and service members' comfort level in knowing that their dependents are residing in a safe community while they are deployed or serving on temporary duty at a distant location.

As a practical matter, termination of Fort Belvoir family housing would prove difficult. If on-post housing were to be terminated over a period of years, in the absence of maintenance funding, the existing housing would become unsuitable due to age or necessity of repairs. Residents could then find themselves living in blighted and partially abandoned neighborhoods. If on-post housing were to be terminated all at once, it is unlikely the private sector could provide the requisite amount of affordable, quality housing, as well as schools, shopping, roads, and other support amenities on short notice.

Rehabilitation of many of the historic family housing units at Fort Belvoir is economically sound. In addition, 270 units were extensively renovated over the last several years and, although lacking some of the amenities that new houses will provide, they still have years of useful life left. Termination of family housing programs would involve abandonment of considerable investments in those facilities that were recently renovated. In addition, abandonment of historic houses would result in unacceptable adverse effects to Fort Belvoir's Historic District, while adapting all of these buildings to nonhousing uses would not be practicable or compatible with their original use.

The various consequences of reliance on the private sector and the management difficulties of effecting termination of family housing on post would prove challenging. In light of the aggregate value of family housing units amenable to rehabilitation, termination of a family housing construction and maintenance program would gravely contravene the fiscal responsibilities the Congress expects of the Army. For these reasons, this alternative is not reasonable and is not further evaluated in this EA.

3.4 Leasing Alternative

Statutory authorities exist for Fort Belvoir to ensure availability of adequate, affordable housing through use of long-term leases of housing for military family use. Key aspects of the two laws providing these authorities are summarized below.

- **Long-term leasing of military family housing to be constructed.** Family housing obtained through use of this authority, which appears at 10 U.S.C. 2835, is most often referred to as "Section 801 Housing." Under this authority, the Army may, through competitive contract procedures, have a developer build or renovate (to residential use) off-post family housing units near an installation. Housing units under this authority must meet DoD specifications. The Army may then lease the units for use as family housing for a period of not more than 20 years. At the end of the lease term, the Army has the option to purchase the housing units from the private developer.

- **Military housing rental guarantee program.** Family housing obtained through use of this authority, which appears at 10 U.S.C. 2836, is most often referred to as "Section 802 Housing." Under this authority, the Army may award a competitive contract to a private developer or a state or local housing authority to construct or rehabilitate housing on or near an installation having a shortage of housing for personnel with or without accompanying dependents. Under the contract, the Army guarantees occupancy levels of the housing units, at rental rates comparable to those for similar units in the same general market. Housing units under this authority must comply with DoD specifications or, in the discretion of the Service secretary, local building codes. A rental guarantee agreement may not exceed 25 years in duration; it may be renewed only for housing that is located on government owned land. The agreement may provide that utilities, trash collection, snow removal, and entomological services be furnished by the Army at no cost to the occupant to the same extent such services are provided to occupants of post housing.

There has been only limited experience with either of the foregoing authorities. An important drawback affecting both programs concerns what is known as budget "scoring," the method of accounting for federal government obligations as required by the Budget Enforcement Act of 1990. Scoring ensures that all government obligations are accounted for when long-term liability is incurred (i.e., during the first year of a project). Scoring guidelines issued by the federal Office of Management and Budget require that a project must be fully funded with sufficient budget authority in its first year to cover the government's long-term commitment. In other words, all potential costs associated with long-term leasing or rental guarantee programs must be recognized in the first year, and they must be considered as part of the Army's total obligation authority (the total monies appropriated by Congress for use by the Army in a given year). For some privatization

projects, such as military leased housing, the Army's obligations for scoring purposes amount to the net present value of the total rent under the lease. These amounts can be nearly as great as the sums required under traditional military construction financing for Army-initiated construction of similar facilities.

The Section 801 housing program and Section 802 rental guarantee program only partially address the Army's purpose and need for the proposed action. Due to the scoring guidelines, the Army would obtain either very little or no leverage benefit.

Enactment of new authorities in the MHPI suggests Congress's recognition that Section 801's and Section 802's drawbacks outweigh potential benefits to the Army. Although use of either or both of the Section 801 and Section 802 authorities would be possible, their use would not be reasonable when compared to the better flexibility and economic advantages of the new authorities offered by the RCI to the Army and to military families. Accordingly, the off-post-leasing alternative is not further evaluated in this EA.

3.5 No Action Alternative

Inclusion of the no action alternative is prescribed by CEQ regulations. Although the no action alternative does not satisfy the purpose and need for the proposed action, it serves as a baseline against which the impacts of the proposed action and alternatives can be evaluated.

Under the no action alternative, Fort Belvoir would not implement the proposed action, but would continue to provide for the family housing needs of its personnel through use of traditional military maintenance and construction procedures. Fort Belvoir would continue to obtain funding for family housing through the Congressional authorization and appropriations process. Based on historical trends, it is assumed that the amount of Congressional funding for family housing would not increase and that the number of units in critical need of renovation would continue to grow. Any major changes to or construction of new housing in the future would require that appropriate NEPA analyses be completed before implementing such actions.

4 Affected Environment and Consequences

4.1 Land Use

4.1.1 Affected Environment

4.1.1.1 Regional Setting

Fort Belvoir is located in southeastern Fairfax County, Virginia (VA), about 12 miles southwest of Washington, District of Columbia (DC), 10 miles from the Pentagon, and 5 miles from Alexandria, VA (Figure 1-1). The Main Post lies near the community of Mount Vernon, alongside the Potomac River, Dogue Creek, Gunston Cove, and Pohick Creek, about 85 miles upstream of the Chesapeake Bay. The installation also exercises direct responsibility for the Engineer Proving Ground (EPG), located about 2 miles northwest of Main Post.

Fairfax County is one of the largest regional jurisdictions in the Washington, D.C., metropolitan area, covering almost 400 square miles (US Army Garrison, 1993). The county is the location of many bedroom communities and employment centers that support the Washington metropolitan area. Fairfax County has been characterized by rapid growth in the residential, industrial, and commercial sectors. Interstate 95 and U.S. Route 1 bisect the county on a generally north-south axis.

Straddling Northern Virginia's U.S. Route 1, Fort Belvoir is divided into two halves, known as the North and South Posts (Clark Pinnacle, 2003). The south post lies on a peninsula adjacent to the Potomac River, Dogue Creek, Pohick Creek and Accotink Creek. The majority of the South Post lies on a plateau with steep slopes leading towards the three rivers. The North Post is surrounded by non-government-owned lands. The installation has two wildlife refuges (the Accotink Bay Wildlife Refuge and the Jackson Miles Abbott Wetland Refuge) and a wildlife corridor which connects Huntley Meadows to the wildlife refuges. Fort Belvoir is home to a variety of birds, mammals, reptiles, amphibians, and fish, including the Bald eagle *(Haliaeetus leucocephalu*s).

January and February are the coldest months at Fort Belvoir with an average temperature of 34 degrees Fahrenheit (°F), and July is the hottest month with an average temperature of 79° F. Average annual precipitation is 42 inches, and is generally well distributed throughout the year. The Atlantic Ocean and Gulf of Mexico are the principal sources of moisture. Moist, tropical air flows from the southwest in summer and early fall. The frost-free season is 265 days at Fort Belvoir. Snowfall averages 20.6 inches, but rarely stays on the ground for more than a few days (US Army Garrison, September 2001).

The greatest potential for flooding occurs in late winter and early spring, but storms in the late summer and fall can also cause flooding. Thunderstorms are common in the summer months, occurring an average of 44 days per year at Fort Belvoir (US Army Garrison, September 2001). Hurricanes, which typically affect the weather in the United States during

August, September, and October, have the potential to cause destructive high winds, torrential rains, and flooding on Fort Belvoir if they enter Virginia or pass close offshore.

4.1.1.2 Installation Land Use

The Fort Belvoir Real Property Master Plan, Long-Range Component (US Army Garrison, 1993) is in the process of being updated. All information presented in this section is based upon the 1993 version. Land use throughout the installation is highly varied and consists of the following categories: administrative, research and development, medical, community facilities, barracks, family housing, service and storage, recreation, environmentally sensitive areas, and training areas (US Army Garrison, September 2001). Table 4-1 describes and Figure 4-1 shows the Land Use categories at Fort Belvoir.

The Fort Belvoir Real Property Master Plan, Long Range Component (US Army Garrison, 1993) divides the installation into six planning districts: South Post, Southwest Area, South Post Core Area, Lower North Post, Upper North Post, and Davison Army Airfield.

Ten of the 12 existing housing villages and the proposed New South Post Village are located in the South Post Planning District. Woodlawn Village and Lewis Heights Village are located in the Lower North Post Planning District.

The South Post Planning District is located on the Belvoir Peninsula and borders Accotink Bay, Dogue Creek, Gunston Cove, and the Potomac River. This planning area encompasses a portion of Fort Belvoir's historic district. Land uses within this area are primarily research and development facilities and educational facilities. The South Post Planning District contains several U.S. Army and DoD tenant organizations, including the Defense Mapping School, the U.S. Army's DeWitt Hospital, and the Defense Systems Management College. In addition, the South Post Planning District contains research and development facilities, family housing, recreation, administration and education, supply and storage.

The Upper and Lower North Post Planning Districts accommodate troop and family housing, support facilities, and large tenant organizations such as the Defense Logistics Agency and the Defense Communication Electronics Evaluation and Testing Activity. These planning districts also include the North Post Golf Course, the Fort Belvoir Elementary School, the commissary, the post exchange, and recreation facilities for military personnel and their families. Each of these districts contains a portion of Fort Belvoir's Forest and Wildlife Corridor. The Lower North Post Planning District contains the 146-acre Jackson Miles Abbott Wetland Refuge (JMAWR) (US Army Garrison, March 2001).

The following table presents general land use categories at Fort Belvoir.

TABLE 4-1
Land Use at Fort Belvoir

Land Use Category	Major Activities
Administration/Education	Installation headquarters, installation administrative offices, Defense Logistics Agency, two major Army Command headquarters, the Adjutant General's office, Army Management Staff college, Defense Acquisition University, and National Imagery and Mapping Agency.
Research and Development	Defense Communications—Electronics Evaluation and Testing Activity, CECOM RDEC, additional sites throughout the installation.
Medical	DeWitt Hospital complex, Logan Dental Clinic, four dispensaries.
Community Facilities	Commissary, post exchange, convenience stores, credit union, automobile service station, education center, library, post office, banks, Sosa Recreation Center, movie theater, self-help center, officers' club, Community Club, child development centers, elementary school.
Family and Troop Housing	Enlisted and officer family housing units, barracks for single enlisted soldiers, and temporary housing rooms for new arrivals and visitors.
Supply/Storage/Maintenance	Warehousing, maintenance facilities, light-industrial areas
Outdoor Recreation	Tennis courts, 36-hole golf course, 9-hole golf course, swimming pools, athletic fields, an archery range, picnic, area soccer fields, two football fields, walking and running trails, Dogue Creek marina.
Environmentally Sensitive Areas	Wildlife and wetland refuges, Forest and Wildlife Corridor, Resource Protection Areas, steep sloping topography, wetlands, floodplains, rare species habitat, cultural resources
Training	Classroom and other training facilities.
Airfield	Davison Army Airfield
Industrial	Filtration plant, former landfill

Source: Fort Belvoir, 2001 Integrated Natural Resources Management Plan (INRMP);

Land uses bordering the proposed New South Post Village and existing housing villages include Environmentally Sensitive Areas, Outdoor Recreation, Troop Housing, Community Facilities, Administration and Education, and Supply/Storage/Maintenance.

As of 2001, Fort Belvoir had nine land leases that accommodate various tenant activities and non-DoD organizations located at the installation. Easements accounted for approximately 88 acres of the installation. They included:

- Utility easements for power transmission lines, natural gas pipelines, communications lines, water and sanitary sewers, which include an off-road right-of-way and an access corridor for maintenance, repairs, and construction; some of these utility easements cross the housing villages and proposed New South Post Village parcel.
- Road rights-of-way, held by the Virginia Department of Transportation (VDOT) along Backlick Road, Telegraph Road, Woodlawn Road, Beulah Street, U.S. Route 1,and the Fairfax County Parkway (VA Route 7100)

- Fort Belvoir Elementary School, which is operated and maintained by the Fairfax County Public Schools system

Fort Belvoir also contains or surrounds eight cemeteries. Six are listed in the Fairfax County Land Records as private properties not owned by the Department of the Army. Two are on property owned by Fort Belvoir (Goodwin, 2001).

4.1.1.3 Context of Fort Belvoir Within Regional Land Use

Fort Belvoir is located in Fairfax County's Lower Potomac Planning District and comprises the LP4-Fort Belvoir Community Planning Sector, one of four Community Planning Sectors within the Lower Potomac Planning District. Sector LP2-Lorton-South Route 1 is east of Fort Belvoir, near the installation's most developed areas, and Sector LP3-Mason Neck is to the southwest, near Fort Belvoir's most undeveloped area. Although local zoning does not apply to Federal property, Fairfax County considers the Fort Belvoir Community Sector (LP4) a Large Institutional Land Area. In the LP-4 portion of the Fairfax County Comprehensive Plan, the county encourages the construction of on-post housing for military families at Fort Belvoir to reduce the competition for affordable housing in the County (Fairfax County, 2002).

The Lorton-South Route 1 Community (LP2) is considered a Suburban Center with Suburban Neighborhood and Low-Density Residential Areas. Major objectives for land use include developing a strong "sense of place" and positive image as well as the preservation and protection of existing, stable residential neighborhoods. The Mason Neck area (LP3) is classified as a Low-Density Residential Area. Recommendations for future land use in Mason Neck include limiting residential density (not to exceed one dwelling unit per acre), to preserve the remaining rural character and to reduce existing septic system problems (Fort Belvoir, 2002; Fairfax County, 2002).

The Lower Potomac Planning District connects Fort Belvoir's open space to other comparable areas in Fairfax County such as floodplains, stream influence zones, and tidal and non-tidal wetlands associated with major watercourses, including the Potomac River. Significant portions of the Mason Neck peninsula immediately south of Fort Belvoir are held in public ownership, and are managed for the protection of important wildlife habitats and wetlands, with public recreation as a secondary use. The Lower Potomac Planning District also includes a number of historic sites and other cultural resources, some of which exist on Fort Belvoir.

According to the Integrated Natural Resources Management Plan (INRMP), undeveloped areas on Fort Belvoir are one component of southeastern Fairfax County's open space network, which contributes to the Chesapeake Bay Program's restoration efforts. The Comprehensive Plan for Fairfax County defines open space as any public or private land existing primarily in a natural condition that helps to shape the character, form, and quality of county development. As defined, these areas are used for environmental and heritage resource protection, parks and recreation, agriculture, visual relief, and buffering between adjacent land uses (US Army Garrison, September 2001).

4.1.1.4 Surrounding Land Use

Land use immediately surrounding Fort Belvoir consists of residential areas, industrial parks, nature parks, and large water bodies (Figure 4-2). The area north of the post is mainly residential, while the area to the northwest consists of industrial and business parks combined with residential land use. West of the Fort Belvoir boundary and the Davison US Army Airfield (located on Fort Belvoir) is the Noman M. Cole, Jr. Pollution Control Plant (formerly the Lower Potomac Pollution Control Plant). Residential areas surround this industrial (wastewater treatment) facility. Gunston Cove, Pohick Bay and Regional Park, Mason Neck State Park and Wildlife Refuge are located south and southwest of the post. The Potomac River and Dogue Creek define the southeast boundary of Fort Belvoir. The eastern portion of the post abuts a residential area and Woodlawn Plantation, an historic property owned and operated by the National Trust. U.S. Route 1 bisects Fort Belvoir and Interstate 95 runs to the west of the post. US Route 1 is a four-lane road at the point where it bisects Fort Belvoir. Fort Belvoir's boundaries run immediately adjacent to the road. Access to Fort Belvoir from U.S. Route 1 is limited to Pence and Tulley Gates.

All of the existing housing villages are surrounded by Fort Belvoir lands, except for Woodlawn Village on North Post and River Village on South Post. Civilian housing areas that are zoned as R-2 (two dwelling units per acre) are located to the east and south of River Village.

Civilian housing areas are located to the east and south of Woodlawn Village. The areas to the east of Woodlawn Village are zoned as R-3 (three dwelling units per acre) and R-2 two dwelling units per acre). The areas to the south of Woodlawn Village are zoned as R-20 (20 dwelling units per acre). Two nature areas (Huntley Meadows Park and the 146-acre Jackson Miles Abbott Wetland Refuge) are located to the north and west of Woodlawn Village. Huntley Meadows consists of 1,424 acres of mature forests, meadows, and wetlands supporting a wide variety of wildlife.

Woodlawn Historic Overlay District

In 1971, Fairfax County established the Woodlawn Historic Overlay District, one of thirteen such districts currently designated by the county. The core of the district encompasses several historic properties: Woodlawn Plantation, Pope/Leighey House, Woodlawn Friends Meeting House (along the north and south sides of Route 1) and George Washington's Grist Mill (on Mount Vernon Highway, northeast of River Village). Lewis Heights Village is entirely within the Overlay District, along with portions of George Washington and River Villages. Fairfax County uses Historic Overlay Districts as a zoning tool to ensure that new construction is compatible with historic resources in designated areas. The provisions of the zoning ordinance are administered by the Fairfax County Architectural Review Board (ARB), which reviews rezoning applications, construction permits, sign permits, site plans, subdivision plats, and grading plans for properties within Historic Overlay Districts. However, local zoning and construction permit approval procedures do not apply to Federal facilities. See Section 4.8 (Cultural Resources) for further discussion.

4.1.2 Consequences

4.1.2.1 Proposed Action

Overall, the proposed action would result in long-term minor beneficial effects on installation land use. Locating the New South Post Village closer to community services is an improvement in land use (see "Land Use Planning Principle" in section 3.0). Existing residential areas would be improved for the designated land use through housing rehabilitation, although the land use designation of these areas would not change. No areas that are currently used for family housing would be converted to other uses. However, related amenities such as recreational areas and village centers would be constructed on these residential land use areas, which would improve their quality for the designated use. Other improvements (for instance, improved storm drainage systems, landscaping with native plants, and placement of buffers between living spaces and noise sources) would also improve the quality and suitability of the residential areas for the designated land use. The addition of these amenities would be expected to result in an overall positive benefit.

Land use planning for the proposed action has been coordinated with the planning process for the updated (2004) Fort Belvoir Master Plan. According to the Land Use GIS layer provided by Fort Belvoir DPW&L in June 2003, most of the land area (94 percent of 548 acres) proposed for transfer with the existing housing villages carries the land use designation of Troop and Family Housing. However, the boundaries of Belvoir, Colyer, Dogue Creek, Fairfax, George Washington, Gerber, Jadwin, Lewis Heights, Park and Rossell Villages, will be expanded to include approximately 31 acres total of land that is currently designated as Administrative/Education. In addition, Dogue Creek and Lewis Heights Villages will be expanded to include approximately 2 acres of land that are currently designated as Community Facility. The land use designations of these areas is being changed to Family Housing in the updated (2004) Fort Belvoir Master Plan.

For the proposed New South Post Village parcel, the proposed action will result in a modification in land use designation from Administrative and Education (approximately 4 acres), Community Facilities (approximately 35 acres), Industrial (approximately 6 acres), and Outdoor Recreation (approximately 35 acres) to Family Housing. Fort Belvoir is currently developing an update to the 1993 Master Plan and will prepare an Environmental Impact Statement to address potential environmental impacts of land use changes for the installation as a whole.

The proposed action would increase acreage in the Family Housing land use category and reduce the total acreage in the Administrative/Education and Community Facilities land use categories. This would slightly reduce the land available for future development of community support facilities and outdoor recreation to serve military personnel and retirees in the region. Under Fort Belvoir's 1993 Real Property Master Plan and subsequent development, the Regional Community Support Center Area on North Post (just west of Lewis Heights Village) is the focal point of community support facilities for the Fort Belvoir community and the large active duty and retired military community residing in the National Capital Region. Therefore, this change is not expected to result in significant adverse effects on future installation land use and development.

The Proposed New South Post Village is adjacent to two other villages, a golf course, and ball fields, which are compatible and desirable adjacent land uses for Family Housing.

The ground lease will be subject to the existing utility easements and similar encumbrances on the parcels.

No direct effects on surrounding land use would be expected. For a discussion of indirect effects, see Section 4.2 (Aesthetics and Visual Resources), Section 4.8 (Cultural Resources) and Section 4.10 (Transportation.)

The redevelopment of Lewis Heights and, to a lesser extent, the demolition of River Village and redevelopment of George Washington Village, would indirectly affect the Woodlawn Historic Overlay District. Local zoning and construction permit approval procedures do not apply to Federal facilities. However, potential effects on the historic properties in the Woodlawn Historic Overlay District will be addressed through the Section 106 consultation process, as discussed in Section 4.8.

4.1.2.2 No Action Alternative

No effects would be expected. No changes to land use designations would occur under the no action alternative. Residential areas would be maintained as they currently are, with no changes or improvements anticipated to occur to existing conditions, other than those undertaken in the course of normal maintenance activities.

4.2 Aesthetics and Visual Resources

4.2.1 Affected Environment

Aesthetics resources consist of natural and man-made landscape features that appear indigenous to the area. Aesthetic resource issues include style, taste, design concept, and urban amenity. By incorporating aesthetics into all land use categories it creates a more pleasing environment for work and recreation. Fort Belvoir displays three forms of land use features that contribute to this aesthetic atmosphere: unimproved, semi-improved, and improved areas on the Post. Unimproved areas feature many diverse landscapes (forests, marshes, and meadows). These natural areas are usually surrounded by semi-improved areas, which include such things as mowed fields and wooded areas that have been cleared of undergrowth. Improved areas at Fort Belvoir include recreational and community facilities, golf courses, housing, research buildings, administration buildings, maintenance facilities, etc. as well as parking lots and roadways (RCSC, 2002).

Although Fort Belvoir has many aesthetically pleasing features, certain elements contribute to impair the visual connectivity surrounding the different housing parcels. These limiting elements are as follows:

- Utility Lines. Overhead utility lines are visually dominant in many parts of the installation and represent an intrusive element of the aesthetic environment.
- Character of architecture. Some of the older, wooden buildings give an impression often described as institutional, monotonous, or lacking in enrichment. This is, however, appropriate to their context and need not be considered a visual impact. Only where these buildings appear to be in disrepair are they considered to be visually intrusive. The uniform color of the buildings in many parts of the installation is considered to be aesthetically appropriate.

- Housing areas at Fort Belvoir are broken down into different villages; each village has differing landscaping as well as surrounding visual elements. Therefore the aesthetic value of each village differs from one another. Some villages have much more to offer the resident aesthetically than others that have little in the way of aesthetic value.

4.2.1.1 Belvoir Village

The Officers Club is located in the eastern side of the housing area, and is concealed from view with large mature trees, which serves to visually distract from the structure. Mature, historic trees are found throughout the improved grounds of Belvoir Village. There is a large open area between Mason and Woodlawn Drives with a tennis court and a playground. Belvoir Village is beautifully landscaped and is one of the more attractive villages on post, not only for its landscaping, but also for the historic aspect of the structures and their setting.

4.2.1.2 Colyer Village

Colyer Village is bordered on the North and east by mature wooded forests, the South golf course borders the West Side, and the Fort Belvoir DeWitt Army Community Hospital on the south side. Those units that are located on the southern side of the complex have a view of the hospital parking lot and hospital buildings. Mature trees as well as a tributary of Dogue Creek border the northern exterior units, while only mature trees border the eastern exterior units. There are medium age landscape trees in the front yards of all housing units. Those few units, which over look Belvoir Road, have a view of the golf course. Although the golf course is manmade and unnatural it is more aesthetically pleasing than a building structure in the residents line of sight.

There is a playground in the middle of the village, but otherwise there is little open space outside of the yards.

4.2.1.3 Dogue Creek Village

The Dogue Creek Village area is bordered on the eastern side by the Dogue Creek. This provides a beautiful backdrop to those units backing to the forest as well as the creek. A park with a playground is also located on the eastern side of the development. Wooded areas also encompass the southern, northern, and western sides of the village. Small tributaries of the Dogue Creek are also located close to some of the housing units. Along with the wooded areas, which back to the exterior units, mature trees also line the neighborhood roads. This landscaping, as well as additional land uses, adds to the aesthetic beauty of the village.

4.2.1.4 Fairfax Village

Forested areas border the North, South, East and West portions of the village. Along with the wooded area, small tributaries of the Potomac River are located in close proximity to the housing units. Mature trees and younger landscape trees are found throughout the improved grounds as well as wooded edges at Fairfax Village adding to the visually pleasing landscape design.

The Belvoir and Potomac View Self-Guided Trail starts at the intersection of Marshall Road and Forney Loop. This is a wonderful opportunity for those residents to enjoy the nature that surrounds them and their homes.

4.2.1.5 George Washington Village

Mature woods border the north, east, and western areas surrounding the village. A walking/running path cuts through the southern portion of George Washington Village. A small tributary of Dogue Creek runs along this path and is used by residents as a recreational outlet. Medium age landscape trees are located in the front yards as well as the improved common areas.

4.2.1.6 Gerber Village

Gerber Village houses are part of Fort Belvoir's Historic District. The area is beautifully landscaped, with large mature trees lining the roads as well as scattered throughout the village. No woods border the village, as it is situated in a developed area of Fort Belvoir.

Gerber Village is adjacent to administrative offices and educational buildings to the south and east. North of the village is a swimming pool and the Fire Station. To the west of the village, separated by a thin strip of trees and a fence, is a row of old warehouses. Even with the close proximity to these developed areas, the landscaping and trees assist in camouflaging the otherwise austere surroundings.

4.2.1.7 Jadwin Village

Jadwin Village is aesthetically pleasing, with large mature trees lining the roadways as well as mature forests bordering the north, south, and east. The homes are widely spaced, which serves to give some additional privacy for the residents. Two small tributaries of Dogue Creek flow on either side of housing unit 464 and run along the back of the units on the northern side. Along with the northern tributary another small tributary of Dogue Creek runs along the southern border of the village. Both small streams serve as visually pleasing aspects of Jadwin Village.

In the middle of the village is an open area with a play ground and a basketball court, which are used for recreational purposes.

4.2.1.8 Lewis Heights Village

Lewis Heights has very little aesthetically pleasing features located in and among the village. A small number of mature trees and young-medium age landscape trees are scattered throughout the improved grounds of Lewis Heights. A large, sparsely wooded field borders the southwest portion of the development, and buildings and open fields surround the remaining borders. The small intermittent stream offers some visual atmosphere, but as it is intermittent the full benefit can not been gained by residents. With the visual restrictions from all sides, the village has little in the way of aesthetic atmosphere.

From outside of the installation, part of Lewis Heights is visible from the adjacent Woodlawn Plantation, which is owned and operated by the National Trust for Historic Preservation. Historic viewshed issues are discussed in Section 4.8.

4.2.1.9 Park Village

Mature trees line the thoroughfares throughout the village. Units are widely spaced, which give residents privacy barriers from one another. Woods border the north, east, and west

portents of the surrounding area. Three of the units back to buildings, but with the landscaping and mature trees, this view is not intrusive. A small tributary of Dogue Creek runs behind some of the end units along Harrington Drive.

4.2.1.10 River Village

River Village has some landscaped and mature trees that are scattered throughout the development. There are medium age landscape trees in all front yards as well as the common areas at River Village. The houses are situated relatively close together but some distance is maintained among the units. Civilian housing borders the southeast sides of the village. Although this could be considered a visual impediment, a small buffer of woods has been left for the northeast side units. The civilian houses that border the southeast side have little in the way of a buffer area. River Village is bordered to the south and east by the main branch of Dogue Creek. The Post's Dogue Creek Marina borders the west side of the development and although considered a manmade structure, it is visually pleasing to the residents. Numerous playgrounds are situated throughout the village, and are used for recreation by resident's children.

4.2.1.11 Rossell Loop Village

Rossell Loop Village is bordered on three sides by medium density of mature trees throughout the improved grounds and woodland edges at Rossell Loop Village. A small tributary of Dogue Creek winds its way around the village area and serves as an aesthetically pleasing backdrop for those residents that live in the outer units. The duplex units are spaced widely and mature trees are scattered along the thoroughfares. A playground as well as a basketball court are located in the interior open area and are for recreational use.

4.2.1.12 Woodlawn Village

The Jackson Miles Abbott Wetland Refuge (JMAWR) borders Woodlawn Village, on the west. This area is a beautiful natural border to those residents of the village. Young landscape trees border the eastern side of the village and are found throughout the housing units (front and back yards) and common grounds at Woodlawn Village. Other housing complexes and townhouses are scattered on the southern end of the village. There is also an open area running through the middle of the village.

4.2.1.13 Proposed New South Housing Village

The northern parcel is a U-shaped area of previously developed land adjacent to the golf course. The majority of the western side of the parcel is cleared with well-maintained green space. The central portion of the parcel is heavily wooded. The eastern portion of the area from the south golf course parking lot to Ferrel Road contains over 30 trees of significant/ historic value, many of which are over 100 years of age. This area is lightly wooded and has a walking trail. The parcel is mostly undeveloped, with the exception of three small buildings, two small parking areas, and some walking trails.

The middle parcel is adjacent to the northern and is located between the Barden School and the Hospital. A small dirt road runs through the property. The eastern side of the parcel slopes downhill towards a small stream. This area is lightly wooded. Portions of the parcel consist of maintained grass.

The southern parcel is south of the Barden School. One structure (Building 1001) and some tennis courts are located on the southern parcel. The remainder of the parcel is made up of landscaped areas around the building and tennis courts, and wooded areas sloping downhill to the southeast.

4.2.2 Consequences

4.2.2.1 Proposed Action

Short-term and long-term adverse effects to aesthetics are expected due to the removal of some of the mature trees and vegetation in the existing housing villages and the proposed new housing village. As discussed in detail in Section 4.7, a tree survey will be conducted to identify and avoid, to the maximum extent practicable, all specimen trees in the housing villages. Steps will be taken to avoid as many of these trees as possible. In cases where it is not possible to avoid impacts to the vegetation, trees will be replaced at a 1:1 ratio on Fort Belvoir. Open areas will be vegetated with trees and shrubs in order to provide a natural park-like setting. Trees and shrubs will be planted along streets and in yards to provide shade, privacy, and energy conservation. The visual effects of removing mature trees and replacing with young trees will continue beyond the construction period. Impacts are only "short-term" in the sense that trees are a renewable resource. Initially, the trees will be young, but with each year's growth they will provide additional shade and privacy screening. A landscape planting and maintenance plan will be developed in coordination with DPW&L ENRD that uses native plants and addresses invasive exotic vegetation management.

Other long-term minor beneficial effects would be expected. Revitalization and reconstruction of existing housing units that are currently in need of upgrading; construction of new, modern housing; and the addition of recreational areas and native-plant landscaping (see Section 2.0) within the housing communities affected by the proposed action would be expected to improve the aesthetic and visual appeal of the villages. Additionally, the placement of new utility lines underground, removal of some existing overhead utility lines, improvements to roads would be expected to have a positive effect on the visual appearance and aesthetic appeal of the villages.

Construction of new garages in Belvoir and Gerber Villages will block the view of some green spaces, which in and of itself is an adverse effect. However, the additional storage space provided to the residents will eliminate the need for temporary storage sheds and allow residents to store belongings in the garages rather then in front, side, and back yards as is currently occurring, resulting in a beneficial effect. The ability to park cars in the garages, rather than on the street, will result in an overall improvement in the view of the neighborhood. Many of the existing garages in Belvoir Village do not meet the current size vehicle requirements causing residents to park on the street or in the driveway. In addition, all construction including garages, street benches, street and yard lighting, in the historic areas will be in agreement with the Programmatic Agreement. Therefore, construction of the new garages is expected to have an overall neutral effect to the views in Belvoir and Gerber Villages.

Construction in the proposed New South Village will result in a significant change in the views. This area is currently composed of a mix of suburban, semi-developed, and

undeveloped areas. Once construction is complete, this area will have the look of a suburban (or "new urban") housing area, including townhouses, streets with sidewalks and gutter systems, street lights, and other usual housing amenities. The yards, streets, and open areas will be re-vegetated with native trees and shrubs and maintained on a regular basis. In addition, a vegetated buffer will be maintained 100-feet from the perennial stream that runs through the property. The neighborhood will become South Post's new "Main Street." Although overall, this new village is a significant change in the appearance of this parcel, it is not a significant adverse effect.

As discussed in Section 4.8, existing vegetation will be maintained to screen the view of housing villages from outside the installation, along the boundaries of Lewis Heights Village with Woodlawn Plantation and River Village with Mount Vernon Memorial Highway.

4.2.2.2 No Action Alternative

Long-term neutral effects would be expected under the No Action alternative.

Under the No Action alternative, housing villages will remain essentially the same as far as structure, road networks, and vegetation. No new housing related construction will occur in the proposed New South Post Village and the two construction sites would not be needed as sites for a rock crusher and/or concrete plant. Stands of forest and mature trees that currently exist would not be removed.

Houses on Fort Belvoir range from 20 to 80 years in age. Many of the houses, especially in the Historic District, are brick, two-story homes in spacious neighborhoods. However, other units are apartment style complexes with no private yards, with shared open areas, and little vegetation. As is the case with many older homes, many of the units need upgrades and are currently in a mild state of disrepair. Due to funding constraints, it is not likely that under the current situation, many of the houses will be upgraded or significant repairs or additions made.

Therefore, overall, the No Action alternative is not expected to have a significant adverse or beneficial impact on the housing villages.

4.3 Air Quality

4.3.1 Affected Environment

4.3.1.1 Regional and Local Air Quality Conditions

Fort Belvoir is located in Fairfax County, Virginia, which is part of the Metropolitan Washington Air Quality Control Region. The U.S. Environmental Protection Agency (USEPA), under the requirements of the 1970 CAA as amended in 1977 and 1990, has established National Ambient Air Quality Standards (NAAQS) for six criteria pollutants – ozone (O_3), carbon monoxide (CO), nitrogen dioxide (NOx), particulate matter (PM), lead (Pb), and sulfur dioxide (SO_2), as shown in Table 4-2 below. The NAAQS include primary and secondary standards. The primary standards were established at levels sufficient to protect public health with an adequate margin of safety. The secondary standards were

established to protect the public welfare from the adverse effects associated with pollutants in the ambient air.

Air quality data for Virginia is collected by the Virginia Department of Environmental Quality (VDEQ) at representative sites throughout the state. The most recent available data (for year 2001) from nearby monitoring stations are used to describe the existing ambient air quality at Fort Belvoir. Measured ambient air concentrations were well below the NAAQS except for ozone. The ozone exceedance is expected since the region within which Fort Belvoir and the ozone monitoring sites are located has been designated an ozone nonattainment area. Table 4-2 below summarizes the local ambient air quality around Fort Belvoir.

TABLE 4-2
National and Virginia Ambient Air Quality Standards

Pollutant and Averaging Time	Monitored Data	Primary Standard		Secondary Standard		Monitoring Site Location
		$\mu g/m^3$	ppm	$\mu g/m^3$	ppm	
Carbon Monoxide				Same as primary		Lee District Park
8- hour concentration	1.9 ppm	10,000[1]	9[1]			
1- hour concentration	3.1 ppm	40,000[1]	35[1]			
Nitrogen Dioxide						
Annual Arithmetic Mean	0.014 ppm	100	0.053	Same as primary		Broad Run High School
Ozone						
8- hour concentration	0.106 ppm	157[2]	0.08[2]	Same as primary		Lee District Park
1- hour concentration	0.119 ppm	235[3]	0.12[3]			
Particulate Matter						
PM2.5:						Lee District Park
Annual Arithmetic Mean	14.3 $\mu g/m^3$	15[4]	-			
24- hour Maximum	40.1 $\mu g/m^3$	65[5]	-	Same as primary		
PM10:						Manassas Health Dept.
Annual Arithmetic Mean	18 $\mu g/m^3$	50[4]	-			
24- hour Maximum	39 $\mu g/m^3$	150[6]	-			
Lead						
Annual Arithmetic Mean)	(a)	1.5	-	Same as primary		(a)
Sulfur Dioxide						
Annual Arithmetic Mean	0.007 ppm	80	0.03	-	-	
24- hour concentration	0.25 ppm	365[1]	0.14[1]	-	-	McLean Gov. Ctr.
3- hour concentration	0.047 ppm	-	-	1300[1]	0.50[1]	

Source: Virginia Ambient Air Monitoring 2001 Data Report, VDEQ and 9 VAC 5 Chapter 30.
Notes:
(a) Lead was not monitored in the Virginia Ambient Air Monitoring 2001 Data Report.
[1] Not to be exceeded more than once per year.
[2] 3-year average of the 4th highest 8-hour concentration may not exceed 0.08 ppm.
[3] Areas not attaining the 1-hour standard must meet that standard before demonstrating attainment with the 8-hour standard.
[4] Based on 3-year average of annual averages.
[5] Based on 3-year average of annual 98th percentile values
[6] Based on a 3-year average of annual 99th percentile values.
ppm = parts per million
$\mu g/m^3$ = micrograms per cubic meter

The CAA requires that the USEPA review scientific data every 5 years to ensure that the NAAQS effectively protect the public health. Effective on September 16, 1997, the USEPA enacted a more stringent standard for ozone of 0.08 parts per million (ppm) measured over

8 hours, with the average fourth-highest concentration over a three-year period determining whether or not an area is in compliance. Additionally, a new standard for particulate matter (PM-2.5) was issued on July 18, 1997 at an annual limit of 15 micrograms per cubic meter ($\mu g/m^3$), with a 24-hour limit of 65 $\mu g/m^3$. Because this new standard would regulate fine particulates for the first time, the USEPA allowed 5 years to build a nationwide monitoring network and to collect and analyze the data needed to designate areas and develop implementation plans (TAMS, July 2002).

Areas that meet the NAAQS for a criteria pollutant are designated as being "in attainment;" areas where a criteria pollutant level exceeds the NAAQS are designated as being "in nonattainment." Ozone nonattainment areas are categorized based on the severity of their pollution problem- marginal, moderate, serious, severe, or extreme. Fort Belvoir has a status of severe nonattainment for ozone, and is considered to be in attainment for the other criteria pollutants.

Based on the attainment status for the area, the Title V major source thresholds (based on the facility's Potential to Emit) applicable to Fort Belvoir are:

- 25 tons per year (tpy) for volatile organic compounds (VOCs) or NOx
- 100 tpy for other criteria pollutants
- 25 tpy for total hazardous air pollutants (HAPs) or 10 tpy for any one HAP

Fort Belvoir is a major source of NOx and SO_2. A Title V permit application was submitted for the installation in March 1998 and a final permit was issued on March 24, 2003. (Werner, Personal communication, April 2003).

4.3.1.2 State Implementation Plan

The CAA amendments of 1990 classifies areas that exceed national health-based air quality standards based upon the severity of their pollution problem (marginal, moderate, serious, and extreme) and prescribes measures and emission reduction requirements to ensure that continual progress toward attainment is made. All areas classified as "serious" or above for ozone nonattainment (including the Washington area encompassing Fort Belvoir) must submit revisions of the State Implementation Plan demonstrating how emissions that contribute to the formation of ozone will be reduced until area reaches attainment.

Until recently, the Metropolitan Washington area was designated as a serious nonattainment area for ozone. The CAA requires that serious nonattainment areas ensure progress toward the attainment goal by achieving a 15 percent reduction in volatile organic chemical (VOCs) by 1996, and an additional 9 percent reduction by 1999.The Metropolitan Washington Air Quality Committee (MWAQC) approved several State Implementation Plans to meet the requirements for serious nonattainment areas: the 15 percent Plan, Phase I and Phase II Plans. The 15 percent Plan was approved in January 1994 and revised in February 1998. The Phase I Attainment Plan, which includes the 9 percent rate of progress requirements was approved in October 1997, and was revised in April 1999. MWAQC approved the Attainment Plan (Phase II) in April 1998 and revised it in January 2000.

The Phase II Plan, also prepared by MWAQC in February 2000 evaluates whether the measure included in the 9 percent plan and other steps being taken are adequate to reach attainment in the Washington metropolitan area. The plan concluded that the Washington

metropolitan area is likely to attain the federal one-hour standard for ozone by 2005, when the emission control measures currently proposed are fully implemented and after ozone transport is reduced. As part of the plan, the Washington region was required to submit a demonstration using an urban air quality model to show that ozone concentrations will be reduced to levels below the federal one-hour standard (MWAQC, 2003). Since attainment is based upon a three-year record of ozone levels, MWAQC anticipated that Washington will attain the ozone standard based upon data from the ozone seasons in 2003-2005. Therefore MWAQC, which includes the state of Virginia, requested an extension of the 1999 attainment date until 2005 (MWAQC, June 2003).

In January 2003, EPA reclassified the Washington metropolitan area as a severe nonattainment area for ozone. In April 2003, EPA published a final rule to conditionally approve the Washington region's severe area SIP if the three states in the region meet nine commitments to EPA, including adopting state regulations to meet CAA Section 182 (d) requirements for severe nonattainment areas; adopt a contingency plan for 1999 Rate of Progress; revise and submit an updated attainment demonstration that reflects revised MOBILE6-based motor vehicle emissions budgets; demonstrate 3 percent per year rate of progress from 1999-2002 and from 2002-2005; adopt contingency measures for failure to make rate of progress in those periods; and submit an analysis of Reasonably Available Control Measures for the region.

Additional SIP requirements for severe nonattainment areas are:

- Lower permit threshold for point sources from 50 tpy to 25 tpy of ozone precursors, NOx and VOCs.
- Lower threshold for definition of "Major" source requiring controls to 25 tpy
- Require new or expanding sources to offset increased emissions by 1.3:1 of ozone precursors, NOx and VOCs.
- Offset emissions growth due to growth in Vehicle Miles Traveled (VMT) by adopting control measures
- Attainment deadline for Severe Areas is November 15, 2005
- Adopt fee for "failure to attain" to be paid by major sources. (MWCOC, June 2003)

The emission target level for 2002 is 347.4 tpy of VOC and 626.1 tpy of NOx. The emission target level for 2005 is 339 tpy for VOC and 538.8 tpy of NOx.

The draft Severe Area SIP is schedule to go to EPA for approval in March 2004. As the Severe Area SIP is still in draft form and is not yet finalized, the last approved SIP is still in effect, which has target emissions of 362.9 tons per day (tpd) of VOCs and 637.1 tpd of NOx.

4.3.1.3 Fort Belvoir Air Emissions

The point sources of air emissions at Fort Belvoir include boilers, generators, incinerators, underground storage tanks (USTs), a firefighting-training facility, and over 225 insignificant sources of air emissions. The insignificant sources include residential and other smaller No. 2 fuel oil and natural gas boilers, and emergency generators as well as closed sanitary landfills, aboveground storage tanks (ASTs), spray painting operations, welding operations, asphalt paving activities, degreasers, oil-water separators, woodworking activities, printing operations, and pesticide application activities (TAMS, July 2002).

Based on the type of pollutants emitted (criteria pollutants or HAPs), the CAA sets forth permit rules and emission standards for sources of certain sizes. The New Source Performance Standards (NSPS) apply to sources emitting criteria pollutants, while the National Emission Standards for Hazardous Air Pollutants (NESHAP) apply to sources emitting HAPs. The USEPA oversees programs for stationary source operating permits (Title V) and for new or modified major stationary source construction and operation (New Source Review) (TAMS, July 2002).

Table 4-3 summarizes the annual emissions of criteria pollutants from these stationary sources, as reported on the 2002 Emission Statement submitted to VDEQ. Emissions from residential heating units and generators were not included in the installation's Title V permit because VDEQ determined that they were insignificant and would be excluded. Additionally, US EPA's guidance, "*Major Source Determinations for Military Installations under the Air Toxics, New Source Review, and Title V Operating Permit Programs of the Clean Air Act,*" August 2, 1996, suggests that the housing can be disaggregated from other sources contributing to Title V. However, disaggregation under this 1996 white paper would need to be verified with VDEQ.

TABLE 4-3
Fort Belvoir Air Emissions- Baseline Conditions 2002

	Pollutants (tons per year)					
	SO_2	NO_x	CO	PM10	VOC	HAP Total
Stationary Sources	19.4	33.1	18.6	4.77	14.0	.065

Notes:
Actual emissions for stationary sources provided from the Fort Belvoir 2002 Emission Statement

The only sources of mobile emissions at Fort Belvoir are from Davison Army Airfield and the vehicular traffic associated with the regular operations of the post.

4.3.2 Consequences

4.3.2.1 Proposed Action

This section discusses the potential impacts to air quality that are associated with the proposed RCI construction projects at Fort Belvoir. The proposed action will involve installing up to 410 new natural gas furnaces and water heaters in New South Post Village and replacing each existing furnace and water heater in each new home in existing villages, totaling 1,630 homes. For the purposes of this EA, it is assumed that each heating unit in the 170 historic homes will also be replaced with new natural gas units. Additionally, new natural gas furnaces will be added with the construction of the Welcome Center, Recreation Center, and five new Village Centers.

The proposed action will also result in increased adverse impacts on air quality during the eight-year construction phase due to construction activities. These impacts are not expected to occur past the construction phase; therefore additional ambient air quality modeling has not been performed. All emissions are expected to be local (i.e., confined to the construction site area) and limited to the duration of the construction activities.

Site preparation, demolition, and rehabilitation, which will include stone crushing activities, a wall panel assembly facility, and possibly a concrete plant, will temporarily increase fugitive dust and air emissions (particularly particulate matter PM-10) during the construction period. The stone crusher, wall panel assembly facility, and concrete batch plant are all powered by electricity and therefore will not produce NOx or VOC emissions. The concrete plant (if an onsite plant is used) will be the same type as the offsite plant owned and operated by Clark Concrete, which can be powered either by a generator or by permanent electric power. The stone crusher will be one of the portable models manufactured by Kolberg-Pioneer/JCI. Although different crusher models may be used during the construction phase (depending on the volume and type of demolition material to be crushed and recycled for pavement at individual villages), all of their portable models can be powered either by a generator or by permanent electric power. FBRC will stipulate in demolition/construction subcontracts that the concrete plant and stone crusher must be powered directly from the electric power line (personal communication, Brad Koch, and Kolberg-Pioneer Website, July 2003).

Fugitive dust emissions also could be generated as a result of construction-related traffic and wind erosion of uncovered demolition and excavation areas. Fugitive dust emissions will be minimized throughout the construction period by use of conventional dust suppression and mitigation techniques such as soil erosion and sedimentation control, restrictions on where vehicles can travel onsite, speed controls for construction vehicles and equipment, and watering of exposed soil and demolition debris to control dust.

Paving operations, which typically produce VOC emissions, will also be conducted during the construction phase. Emissions from paving equipment have been incorporated in the emission estimates as part of construction vehicle emissions. Cutback asphalt (i.e., asphalt cement that has been liquefied by blending with petroleum (VOC) solvents) is sometimes used as a primer on the stone sub base prior to placing the base coat of paving. However, paving operations under the proposed action will not use VOC-containing materials; therefore, there will not be VOC emissions (personal communication, Tom Sedeski, July 2003).

There will also be emissions associated with engine exhaust from added personal vehicles and off-road construction equipment, including earth-moving equipment, paving equipment, cranes, and trucks. These emissions would primarily consist of NO_x, SO_2, PM, CO, and VOCs, which are typical of the type of emissions commonly observed at construction sites. Emissions will be minimized by assuring proper operation of the equipment.

Table 4-4 summarizes the projected total air emissions from stationary sources, vehicular (mobile) sources and construction activities. The projected emissions have been estimated for each year of construction activity. Detailed emission calculations for these sources are presented in Appendix B.

TABLE 4-4
Summary of Proposed Action Actual Emissions Fort Belvoir, Virginia

Activities	Annual Actual Emissions (tpy)				
	VOC	CO	NOx	SO2	PM-10
Year 2004					
Stationary Sources					
Heating Units (Net Change)	7.51E-04	0.005	0.013	8.19E-05	0.001
Stone Crusher[2]	--	--	--	--	0
Wall Panel Assembly Facility[2]	--	--	--	--	0
Concrete Batch Plant[2]	--	--	--	--	0.031
Subtotal	**7.51E-04**	**0.005**	**0.013**	**8.19E-05**	**0.032**
Mobile Sources					
On-Road Vehicles (Personal)	0.19	2.95	0.33	0.024	0.25
Off-Road Vehicles (Construction)	1.30	5.58	8.57	1.22	0.79
Subtotal	**1.50**	**8.53**	**8.90**	**1.25**	**1.04**
2004 Total	***1.50***	***8.54***	***8.91***	***1.25***	***1.08***
Year 2005					
Stationary Sources					
Heating Units (Net Change)	0.17	1.15	2.50	-0.96	0.18
Stone Crusher[2]	--	--	--	--	0.007
Wall Panel Assembly Facility[2]	--	--	--	--	0.001
Concrete Batch Plant[2]	--	--	--	--	0.031
Subtotal	**0.17**	**1.15**	**2.50**	**-0.96**	**0.22**
Mobile Sources					
On-Road Vehicles (Personal)	0.19	2.95	0.33	0.024	0.25
Off-Road Vehicles (Construction)	1.93	7.98	11.6	1.68	1.18
Subtotal	**2.12**	**10.9**	**11.9**	**1.71**	**1.43**
2005 Total	***2.29***	***12.1***	***14.4***	***0.75***	***1.66***
Year 2006					
Stationary Sources					
Heating Units (Net Change)	0.27	1.99	4.68	0.030	0.38
Stone Crusher[2]	--	--	--	--	0.003
Wall Panel Assembly Facility[2]	--	--	--	--	0.001
Concrete Batch Plant[2]	--	--	--	--	0.031
Subtotal	**0.27**	**1.99**	**4.68**	**0.030**	**0.41**
Mobile Sources					
On-Road Vehicles (Personal)	0.35	5.37	0.59	0.044	0.46
Off-Road Vehicles (Construction)	2.63	11.1	16.5	2.37	1.59
Subtotal	**2.98**	**16.4**	**17.1**	**2.42**	**2.05**
2006 Total	***3.26***	***18.4***	***21.8***	***2.45***	***2.46***
Year 2007					
Stationary Sources					
Heating Units (Net Change)	0.26	1.89	4.43	0.028	0.358

TABLE 4-4
Summary of Proposed Action Actual Emissions Fort Belvoir, Virginia

Activities	Annual Actual Emissions (tpy)				
	VOC	**CO**	**NOx**	**SO2**	**PM-10**
Stone Crusher[2]	--	--	--	--	0.003
Wall Panel Assembly Facility[2]	--	--	--	--	0.001
Concrete Batch Plant[2]	--	--	--	--	0.031
Subtotal	**0.26**	**1.89**	**4.43**	**0.028**	**0.39**
Mobile Sources					
On-Road Vehicles (Personal)	0.35	5.37	0.59	0.044	0.46
Off-Road Vehicles (Construction)	2.76	11.6	17.4	2.50	1.69
Subtotal	**3.11**	**17.0**	**18.0**	**2.55**	**2.15**
2007 Total	**3.37**	**18.9**	**22.4**	**2.57**	**2.55**
	Year 2008				
Stationary Sources					
Heating Units (Net Change)	0.19	1.36	3.21	0.020	0.26
Stone Crusher[2]	--	--	--	-	0.002
Wall Panel Assembly Facility[2]	--	--	--	-	0.001
Concrete Batch Plant[2]	--	--	--	--	0.031
Subtotal	**0.19**	**1.36**	**3.21**	**0.020**	**0.29**
Mobile Sources					
On-Road Vehicles (Personal)	0.35	5.37	0.59	0.044	0.46
Off-Road Vehicles (Construction)	2.28	9.63	14.5	2.08	1.37
Subtotal	**2.63**	**15.0**	**15.1**	**2.13**	**1.84**
2008 Total	**2.81**	**16.4**	**18.3**	**2.15**	**2.13**
	Year 2009				
Stationary Sources					
Heating Units (Net Change)	0.063	0.46	1.08	0.007	0.088
Stone Crusher[2]	--	--	--	--	0.001
Wall Panel Assembly Facility[2]	--	--	--	--	0.001
Concrete Batch Plant[2]	--	--	--	--	0.018
Subtotal	**0.063**	**0.46**	**1.08**	**0.007**	**0.11**
Mobile Sources					
On-Road Vehicles (Personal)	0.19	2.95	0.33	0.024	0.25
Off-Road Vehicles (Construction)	0.88	3.71	5.52	0.80	0.53
Subtotal	**1.08**	**6.67**	**5.85**	**0.82**	**0.79**
2009 Total	**1.14**	**7.13**	**6.93**	**0.83**	**0.90**
	Year 2010				
Stationary Sources					
Heating Units (Net Change)	0.009	-0.020	-0.32	-1.38	-0.050
Stone Crusher[2]	--	--	--	--	0.001
Wall Panel Assembly Facility[2]	--	--	--	--	0.001
Concrete Batch Plant[2]	--	--	--	--	0.009
Subtotal	**0.009**	**-0.020**	**-0.32**	**-1.38**	**-0.04**

TABLE 4-4
Summary of Proposed Action Actual Emissions Fort Belvoir, Virginia

Activities	Annual Actual Emissions (tpy)				
	VOC	CO	NOx	SO2	PM-10
Mobile Sources					
On-Road Vehicles (Personal)	0.12	1.79	0.20	0.015	0.15
Off-Road Vehicles (Construction)	0.22	0.86	1.15	0.17	0.14
Subtotal	**0.33**	**2.65**	**1.35**	**0.19**	**0.29**
2010 Total	**0.34**	**2.63**	**1.03**	**-1.20**	**0.25**
	Year 2011				
Stationary Sources					
Heating Units (Net Change)	0.039	0.28	0.67	0.004	0.054
Stone Crusher[2]	--	--	--	--	0.001
Wall Panel Assembly Facility[2]	--	--	--	--	0
Concrete Batch Plant[2]	--	--	--	--	0
Subtotal	**0.039**	**0.28**	**0.67**	**0.004**	**0.055**
Mobile Sources					
On-Road Vehicles (Personal)	0.12	1.79	0.20	0.015	0.15
Off-Road Vehicles (Construction)	0.056	0.19	0.18	0.030	0.033
Subtotal	**0.17**	**1.98**	**0.38**	**0.045**	**0.19**
2011 Total	**0.21**	**2.27**	**1.04**	**0.049**	**0.24**

Notes:

1-Due to phasing the construction work over the 8-year period, air emissions, specifically NOx, have been reduced below 25 tpy.

2-The stone crusher, wall panel assembly facility, and concrete batch plant are all powered by electricity. Therefore, only emissions from particulate matter are quantified.

New Source Review Program

CAA regulations require that any owner/operator proposing a "new source" such as proposing to 1) build a new major stationary source of criteria air pollutants; or 2) perform major modifications to an existing stationary source of criteria air pollutants, in an air quality control region must apply for a preconstruction air emissions permit and submit to certain preconstruction review requirements and mitigation. These preconstruction review regulations for new sources fall under two major programs: 1) Prevention of Significant Deterioration (PSD) provisions (for attainment areas) and 2) Nonattainment Area (NAA) provisions.

Upon final engineering designs, FBRC in coordination with DPW&L-ENRD will apply for any required permits for new or modified stationary sources and new construction support facilities under the proposed action and in accordance with all applicable state regulations, including but not limited to 9 VAC 5-50-260 (Emission Standards for New and Modified Stationary Sources) and 9 VAC 5-80 (Permits for New and Modified Stationary Sources).

PSD

The PSD program is designed to keep an attainment area in continued compliance with the NAAQS. This is accomplished by the major source or major modification obtaining a

preconstruction permit demonstrating it will implement best available control technologies (BACT) to control future emissions of pollutants. Additionally, an ambient air quality analysis of the impacts of construction and operation of a new or modified major source is required.

Major sources, according to 9 VAC 5-80-1710, are defined as any stationary source that emits or has the potential to emit 250 tpy or more of any pollutant regulated under the CAA.

Major modifications are defined as any physical or operational change that would result in a "significant net increase in emissions" from a stationary source located in an air quality control region. According to 9 Virginia Administrative Code (VAC) 5-80-1710, a significant net increase in emissions means a rate of emissions that would equal or exceed any of the following rates:

- CO—100 tpy
- NOx, SO_2, VOC—40 tpy
- PM10—15 tpy

Per the USEPA's guidance, "Major Source Determinations for Military Installations under the Air Toxics, New Source Review, and Title V Operating Permit Programs of the Clean Air Act", August 2, 1996, residential housing may be disaggregated from the installation in determining a major source. However, disaggregation under this 1996 white paper would need to be verified with VDEQ. If considered separate, then FBRC would need to evaluate the total emissions separately as a minor NSR or major NSR source for permitting purposes.

Even if not disaggregated, projected emissions from the heating units are well below the PSD major source or major modification threshold levels. Projected emissions due to construction activities are not a major modification and also do not meet the major source potential to emit threshold. Therefore, the proposed action would not be subject to PSD requirements. Projected emission estimates are shown in Table 4-5.

NAA

NAA provisions are designed to facilitate efforts to improve degraded ambient air quality and bring nonattainment areas into attainment. Achievement of the net improvement is done through the application of lowest achievable emission rate (LAER) technology, emission offsets, alternative site analysis, and compliance certification.

The provisions of NAA apply to the construction of any major stationary source or major modification to a major source, if the source or modification is or would be major for the pollutant for which the area is designated nonattainment (9 VAC 5-80-2000). Source modifications that result in a significant increase of a pollutant for which the source is major and designated nonattainment require NAA review. Fort Belvoir is located in a severe nonattainment area for ozone and is a major source for NOx and SO_2. Therefore, NAA requirements would apply to this proposed project for ozone precursors, VOC and NOx if emissions of these pollutants from the proposed action exceed NAA thresholds.

Major sources, according to 9 VAC 5-80-1710, are defined as any stationary source that emits or has the potential to emit 25 tpy or more of VOC or NOx in ozone nonattainment areas classified as severe in 9 VAC 5-20-204 A.

Major modifications are defined as any physical or operational change that would result in a "significant net increase in emissions" of qualifying nonattainment pollutant. According to 9 VAC 5-80-2010, a significant net increase in emissions means a rate of emissions that would equal or exceed any of the following rates:

- NOx, VOC- 25 tpy

Per US EPA's guidance, "Major Source Determinations for Military Installations under the Air Toxics, New Source Review, and Title V Operating Permit Programs of the Clean Air Act", August 2, 1996, heating units from residential housing may be disaggregated from the installation in determining a major source. However, disaggregation under this 1996 white paper would need to be verified with VDEQ. If considered separate, then FBRC would need to evaluate the total emissions separately as a minor NSR or major NSR source for permitting purposes.

Additionally, potential emissions from proposed heating units are below the NAA major modification thresholds and therefore would not be subject to NAA requirements. There are no emissions of nonattainment area pollutants from construction activities. The potential-to-emit-emission estimates are shown in Table 4-5. As the table shows, the highest year of potential emissions is 2007, with 22.5 tpy of NOx.

TABLE 4-5
Summary of Stationary Sources Potential Emissions
Fort Belvoir, Virginia

Activities	Annual Potential Emissions (tpy)				
	VOC	CO	NOx	SO2	PM-10
Year 2004					
Heating Units	0.010	0.070	0.16	0.001	0.013
Stone Crusher[2]	--	--	--	--	0
Wall Panel Assembly Facility[2]	--	--	--	--	0
Concrete Batch Plant[2]	--	--	--	--	0.066
Year 2004 Total (tpy)	**0.010**	**0.070**	**0.16**	**0.001**	**0.080**
Year 2005					
Heating Units	1.06	7.69	18.1	0.12	1.46
Stone Crusher[2]	--	--	--	--	0.016
Wall Panel Assembly Facility[2]	--	--	--	--	0.028
Concrete Batch Plant[2]	--	--	--	--	0.066
Year 2005 Total (tpy)	**1.06**	**7.69**	**18.1**	**0.12**	**1.57**
Year 2006					
Heating Units	1.19	8.64	20.3	0.13	1.64
Stone Crusher[2]	--	--	--	--	0.006
Wall Panel Assembly Facility[2]	--	--	--	--	0.028
Concrete Batch Plant[2]	--	--	--	--	0.066
Year 2006 Total (tpy)	**1.19**	**8.64**	**20.3**	**0.13**	**1.74**
Year 2007					
Heating Units	1.32	9.58	22.5	0.14	1.82
Stone Crusher[2]	--	--	--	--	0.006

TABLE 4-5
Summary of Stationary Sources Potential Emissions
Fort Belvoir, Virginia

Activities	Annual Potential Emissions (tpy)				
	VOC	CO	NOx	SO2	PM-10
Wall Panel Assembly Facility[2]	--	--	--	--	0.028
Concrete Batch Plant[2]	--	--	--	--	0.066
Year 2007 Total (tpy)	**1.32**	**9.58**	**22.5**	**0.14**	**1.92**
Year 2008					
Heating Units	0.94	6.82	16.0	0.10	1.30
Stone Crusher[2]	--	--	--	--	0.004
Wall Panel Assembly Facility[2]	--	--	--	--	0.028
Concrete Batch Plant[2]	--	--	--	--	0.066
Year 2008 Total (tpy)	**0.94**	**6.82**	**16.0**	**0.10**	**1.39**
Year 2009					
Heating Units	0.33	2.39	5.61	0.036	0.45
Stone Crusher[2]	--	--	--	--	0.001
Wall Panel Assembly Facility[2]	--	--	--	--	0.028
Concrete Batch Plant[2]	--	--	--	--	0.039
Year 2009 Total (tpy)	**0.33**	**2.39**	**5.61**	**0.036**	**0.52**
Year 2010					
Heating Units	0.18	1.31	3.07	0.020	0.25
Stone Crusher[2]	--	--	--	--	0.001
Wall Panel Assembly Facility[2]	--	--	--	--	0.028
Concrete Batch Plant[2]	--	--	--	--	0.019
Year 2010 Total (tpy)	**0.18**	**1.31**	**3.07**	**0.020**	**0.30**
Year 2011					
Heating Units	0.25	1.84	4.33	0.028	0.35
Stone Crusher[2]	--	--	--	--	0.001
Wall Panel Assembly Facility[2]	--	--	--	--	0
Concrete Batch Plant[2]	--	--	--	--	0
Year 2011 Total (tpy)	**0.25**	**1.84**	**4.33**	**0.028**	**0.35**

Notes:

1. Due to phasing the construction work over the 8-year period, air emissions, specifically NOx, have been reduced below 25 tpy.

2. The stone crusher, wall panel assembly facility, and concrete batch plant are all powered by electricity. Therefore, only emissions from particulate matter are quantified.

Other development projects on the post that have begun or will be in operation concurrently with the proposed action have projected emissions ranging from 19.8 tpy to 52.2 tpy for the years 2004-2008 (DIS-ENRD, August 2001). The combined impact of these sources, along with the proposed action will most likely cause stationary sources at the post to be subject to nonattainment NSR permitting requirements because of the potential post-wide NOx net increase above the NSR threshold of 25 tpy. The applicability of NSR requirements because

of the potential post-wide NOx net increase may need to be reviewed again as these projects reach the air permitting and facility final design stage.

General Conformity

The CAA General Conformity Rule (40 CFR Parts 6, 51, and 93 and 93 and 9 VAC 5-160) requires federal agencies to make written conformity determinations for federal actions in or affecting nonattainment or maintenance areas. Proposals for federal actions must include evaluations of potential changes in direct and indirect air emissions caused by the actions and must determine whether the actions conform to applicable state and federal implementation plans.

The maximum increase in air emissions that is exempt from a detailed air quality analysis is called the *de minimis* level. As defined by the general conformity rule, if the emissions of a criteria pollutant (or its precursors) do not exceed the *de minimis* level, the federal action has minimal air quality impact, and therefore, the action is determined to conform for the pollutant under study and no further analysis is necessary. Conversely, if the total direct and indirect emissions of a pollutant are above the *de minimis* level, a formal general conformity determination is required for that pollutant. The *de minimis* levels for each pollutant are defined in the Federal Conformity Rule and vary depending on the pollutant and the severity of the nonattainment status.

Fort Belvoir is in Fairfax County, Virginia, an attainment area for all NAAQS pollutants except ozone, and a severe nonattainment area for ozone. Because ozone is the only pollutant with a nonattainment status, the ozone precursors, NO_x, and VOCs are the only pollutants that require evaluation. For a severe ozone nonattainment area, the *de minimis* criterion is 25 tpy for both NOx and VOC.

Information provided by the post on existing air permits and current data was used to determine air emissions under the existing conditions. Where appropriate, the same methods were used to calculate emissions estimates for conditions under the proposed action. This technique establishes a basis for determining the change in emissions caused by the proposed action.

Table 4-6 summarizes the annual changes in emissions for the actions analyzed in this EA and how they compare with the *de minimis* levels for the area.

TABLE 4-6
General Conformity Analysis
Fort Belvoir, Virginia

Activities	Annual Actual Emissions (tpy)	
	VOC	NOx
2004 Total	*1.50*	*8.91*
2005 Total	*2.29*	*14.4*
2006 Total	*3.26*	*21.8*
2007 Total	3.37	22.4
2008 Total	*2.81*	*18.3*
2009 Total	*1.14*	*6.93*

2010 Total	*0.34*	*1.03*
2011 Total	*0.21*	*1.04*
***De minimis* level**	**25.0**	**25.0**

Due to phasing the construction work over an eight year period, the net increase in emissions associated with the proposed action, as shown in Table 4-6 is below the *de minimis* levels (25 tpy) for NOx and VOCs. The calculations in Appendix B show the detailed activities generating air emissions on a yearly basis from 2004 through 2011. On the basis of the *de minimis* level criteria set for the in the General Conformity rule, the proposed action is exempt from the CAA conformity requirements and does not require a detailed analysis of air quality. A "Record of Non-Applicability to the General Conformity Rule" (RONA) is attached in Appendix B.

The Phase I Attainment Plan (MWAQC, 1997) provides daily target levels of 362.9 tons per day (tpd) of VOCs and 637.1 tpd of NOx for the metropolitan Washington ozone nonattainment area (which includes Fairfax County). The increase in annual emissions would not make up 10 percent or more of the available regional emission inventory for VOCs or NOx (nonattainment pollutants), and thus would not be regionally significant, per 9 VAC 5-160-20. The project would also be regionally insignificant under the Draft Severe SIP proposed emission targets, which are 347.4 tpy of VOC and 626.1 tpy of NOx for 2002 and 339 tpy for VOC and 538.8 tpy of NOx for 2005.

Emission estimates have been calculated by phasing the proposed action over 8 years in order to reduce NOx emission levels to below 25 tpy. These conforming levels will be maintained by controlling the phasing of the construction and hours of equipment operation in order to remain below *de minimis*. Upon final engineering analysis and economic feasibility analysis for construction activities, estimated emissions might be reduced. The installation does have option to not grant leases for the temporary construction support facilities in order to reduce air emissions.

4.3.2.2 No Action Alternative

Under the no action alternative, air pollutant emissions associated with the proposed action would not occur. However, it is expected that there would be net increases in stationary source emissions on the post from the implementation of other post-wide development projects within the next few years.

4.4 Noise

4.4.1 Affected Environment

Noise is defined as unwanted sound that interferes with normal human activities. There is a wide diversity of human responses to noise, which vary according to the type and characteristics of the noise source. For the Army, high sound levels are both part of the job of operating weapons systems and a necessary training condition since soldiers must learn to function in an environment similar to what they will encounter on the battlefield. Noise also affects wildlife populations.

The basic unit used to represent given sound levels is the decibel. Table 4-7 presents a range of decibel sound levels. A straight, unmodified decibel level is not used, however. To quantify the intrusiveness of nighttime noise, the USEPA recommends a special type of 24-hour average known as the day-night level, or L_{dn}. The L_{dn} is calculated so that noises that occur after 10 p.m. and before 7 a.m. are treated as if they are 10 decibels more intense. (Acentech, Inc., cited in USACE Fort Worth District, 1998).

Noise naturally dissipates by atmospheric attenuation as it travels through the air. Some other factors that can affect the amount of attenuation are ground surface, foliage, topography, and humidity. For each doubling of distance from a noise source, the level can be expected to decrease by approximately 6 decibels.

Currently, the major noise sources on Fort Belvoir include the Davidson Army Airfield and the 249th Engineering Battalion (Prime Power). Prime Power uses diesel generators for training purposes. The noise level of the generators range from 107 decibel A-rated (dBA) to 114 dBA. These noise sources are not in the vicinity of any residential area or the newly proposed village areas (Adams, 2002).

The current noise around and within the New South Post Parcel Village area would be considered consistent with noise around a typical commercial or office area. The contributing noise around the South Post Parcel area include light traffic along 12th Street and Belvoir Road, activities within or near the commercial areas (i.e., Van Noy Library, Post Chapels, Child Development Center, Logan Dental Clinic, Body Shop fitness center, Barden Education Center, Soldier and Family Support Center), and activities within or near the Barden Education Center, Soldier, Family Support Center and the Youth Center. Currently the noise within the residential areas of the RCI footprint would be considered consistent with normal suburban residential noise conditions.

TABLE 4-7
Common Sound Levels

Location/Activity	Sound Levels (decibels)
Near Jet plane at takeoff	140
Near air-raid siren	130
Threshold of pain	120
Thunder	110
Garbage truck, trailer truck at roadside	110
Stone Crushing (Temporary Construction Site)	90 to 108*
Power lawnmower at 50 feet	90
Backhoe, Paver	85
Cement mixer, Power saw	80
Compressor	75
Freeway traffic at 50 feet	70
Conversational speech	60

TABLE 4-7
Common Sound Levels

Average residence	50
Bedroom	40
Soft whisper at 15 feet	30
Rustle of leaves	20
Breathing	10
Threshold of hearing	0

* - Estimated sound pressure levels for all activities involved in stone crushing (i.e., crusher, feeder, and screen)

Source: Acentech, Inc., 1990, cited in USACE Fort Worth District, 1998

4.4.2 Consequences

4.4.2.1 Proposed action

Short-term minor adverse effects would be expected. Given that construction activities will occur in phases throughout the RCI footprint, the project duration (8 years), and noise will be intermittent at some locations depending upon the activity (i.e., the stone crusher at the temporary construction site). These short-term minor adverse effects would be in the annoyance range (above 70 decibels) for residents and wildlife. Occupational Safety and Health Administration (OSHA) standards should protect any construction workers who would be closer to the source of any new noise.

Implementation of the proposed action would be expected to result in additional sources of noise during construction activities due to the operation of construction equipment and construction activities in general. Noise produced by construction equipment varies considerably depending on the type of equipment used and its operation and maintenance (Table 4-7). Typical equipment anticipated at the project sites includes backhoes, loaders, bulldozers, rollers, motor graders, power saws, and compressors.

During demolition, construction, and/or renovation, sensitive receptors to noise within the RCI footprint include the occupants of each nearby village area at the time of the project activities. Sensitive receptors to noise adjacent to the RCI footprint near the residential areas include the Fort Belvoir Elementary School and North Post Child Development Center near the Lewis Heights residential area; and the Dewitt Hospital and administrative offices adjacent to Colyer Village. The off-post residences closest to construction activities are located 100-150 feet south of Woodlawn Village across Pole Road; about 100 feet southeast side of River Village (separated by a 50-vegetated buffer); and about 200 feet northeast of River Village across Mount Vernon Memorial Highway.

Sensitive receptors to noise directly adjacent to the New South Post Village parcel include the Dewitt Hospital, administrative offices, Logan Dental Clinic, South Post Child Development Center, Van Noy Library, Religious Center, Barden Education Center, and the Youth Services Center. The closest residential area to the New South Post Village parcel is Colyer Village, which is adjacent to the parcel on the northeast corner. The next closest

residential areas to the New South Post Village parcel area are located approximately 1,500 feet to the east (Dogue Creek) and southeast (Park Village) of the parcel.

Sensitive receptors to noise near the stone crushing temporary construction site include the veterinary clinic, located approximately 200 feet east of the stone crushing temporary construction site. The noise produced at this site may be a nuisance to the animals within the clinic. However, the noise generated at this site will be intermittent. Rock crushing activities will not be conducted on a regular basis. Materials will be stockpiled during demolition and run through the crusher toward the end of major demolition activities or as needed for road building. Noise should not be a concern at the lumberyard temporary construction site, because the noisy panel construction activities will occur indoors.

During the duration of the project, wildlife might experience some annoyance from noise; however, the noise would be of short duration and intermittent. Wildlife living in the vicinity of the RCI footprint is acclimated to a suburban noise environment and would not be adversely affected by the closer proximity of the noise from a residential setting upon completion of the construction.

The noise generated during the demolition, construction, and/or renovation activities will be limited to daylight hours. Because the project will be implemented in phases, construction noise generated will be on-going for the full 8-year duration within the RCI footprint, but not on-going for the full project duration within each project site, except for the temporary construction sites (stone crushing and lumber yard).

FBRC will respect distances and sound-mitigation techniques in regards to all home replacement, new housing, and renovation activities and will consult and coordinate with the Fort Belvoir Industrial Hygienist and the representatives of each sensitive receptor during the project as needed.

4.4.2.2 No Action Alternative

No effects would be expected.

4.5 Geology and Soils

4.5.1 Affected Environment

4.5.1.1 Geology and Topography

Fairfax County lies within the Coastal Plain and Piedmont Physiographic Provinces. The fall line separating these provinces trends northeast to southeast, and is roughly parallel to Interstate 95 in the vicinity of Fort Belvoir. Fort Belvoir's Main Post lies within the Coastal Plain Physiographic Province. 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 Cretaceous sediments that belong to the Potomac Group (Larson and Froelich, 1977, as cited in US Army Garrison, March 2001). These sediments consist of predominantly lenticular deposits of sand, silt, clay, and gravel of non-marine origin (Force, 1975, as cited in US Army Garrison, March 2001). The Potomac Group

is about 600-feet thick beneath most of the installation (Law and Froelich, 1977, as cited in US Army Garrison, March 2001).

The topography of Fort Belvoir consists of two nearly level plateaus that run south-southeast towards the Potomac River, and slope steeply to lowlands that are primarily associated with the floodplains of Accotink and Dogue Creeks (US Army Garrison, September 2001). Steep slopes, ravines, and stream valleys surround the two plateaus on the east, south, and west sides. The installation ranges in elevation from approximately mean sea level (msl) along the Potomac River to 230 feet above msl at the intersection of Beulah and Woodlawn Roads. Uplands and plateaus make up about 40 percent of the Main Post's land area, lowlands make up another 40 percent, and steep slopes make up 20 percent.

A combination of weakly cemented sedimentary substrates and exposure to erosive forces of wind and water near the Potomac River are mainly responsible for unstable steep slope conditions. Steep and highly erodible slopes are also found along the eastern and western edges of the western plateau and in deeply cut stream channels (US Army Garrison, March 2001).

4.5.1.2 Soils

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 and the dominant geomorphic process in these areas is mass wasting that includes downhill creep, landslides, slumping, and rock falls. Lowlands and valley bottoms are typically underlain with alluvium. The dominant geomorphic process 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 and increasing with construction activity and the removal of vegetation, which greatly increases the rate of erosion and the probability of creep and slumping (US Army Garrison, March 2001).

The Soil Conservation Service (SCS) surveyed soils at Fort Belvoir in 1982. According to the survey, there are nineteen named soil series on Fort Belvoir, as well as areas of mixed alluvium (Entisols) and tidal marsh (Histosols) that are not sufficiently defined to be classified as series. The urban built-up unit (UB [1,898 acres]) includes primarily ridge top or other well-drained flatter areas that have been minimally to drastically disturbed by construction and development over the years. The cut and fill unit (587 acres) is generally of unknown source, but it is likely to be material selected for high structural stability following placement. Table 4-8 lists the soils mapped within Fort Belvoir and the housing parcels in which they fall. Soils within the villages consist mostly of the UB unit. A complete table of the soil units at Fort Belvoir and detailed descriptions of each is provided in Appendix C. In addition, soil units on Fort Belvoir are shown on Figure 4-3.

TABLE 4-8
Soil Types by Village

Village	Soil Type	Acres
Belvoir Village	61E	3.5
Belvoir Village	61 C	0.2
Belvoir Village	UB	58.1
Colyer Village	61D	0.5
Colyer Village	37 B	3.2
Colyer Village	UB	11.3
Dogue Creek Village	26 A	0.1
Dogue Creek Village	46B	0.8
Dogue Creek Village	53A	3.2
Dogue Creek Village	61 C	0.3
Dogue Creek Village	61D	1.5
Dogue Creek Village	61 E	0.2
Dogue Creek Village	85 A	0.2
Dogue Creek Village	UB	36.5
Fairfax Village	100 C	0.4
Fairfax Village	37 B	0.8
Fairfax Village	61 D	2.3
Fairfax Village	UB	38.2
George Washington Village	51B	0.4
George Washington Village	61D	7.6
George Washington Village	UB	36.7
Gerber Village	UB	34.7
Jadwin Village	61 C	0.002
Jadwin Village	61D	0.4
Jadwin Village	61E	0.1
Jadwin Village	UB	28.6
Lewis Heights Village	54B	0.9
Lewis Heights Village	UB	46.8
New South Post Village	37 B	21.5
New South Post Village	45 B	0.7
New South Post Village	46 A	7.1
New South Post Village	46 C	4.1
New South Post Village	54 B	0.9
New South Post Village	61 C	7.3
New South Post Village	61 D	0.04

TABLE 4-8
Soil Types by Village

Village	Soil Type	Acres
New South Post Village	61E	1.1
New South Post Village	CF	3.3
New South Post Village	UB	34.3
Park Village	61C	9.6
Park Village	61 E	0.5
Park Village	UB	4.3
River Village	34 C	0.01
River Village	UB	37.7
Rossell Loop Village	61E	0.1
Rossell Loop Village	UB	18.5
Woodlawn Village	26A	1.4
Woodlawn Village	34B	2.6
Woodlawn Village	35A	6.1
Woodlawn Village	51A	16.2
Woodlawn Village	53A	13.3
Woodlawn Village	CF	4.3
Woodlawn Village	UB	112.8
Construction Support Sites	37 B	4.8
Construction Support Sites	46 B	7.4
Construction Support Sites	61 C	0.2
Construction Support Sites	61 D	0.02
Construction Support Sites	UB	13.6

The Fort Belvoir Master Plan (Fort Belvoir 1993) designates soils with slopes of 15 percent or greater as steep slopes. Soils on these slopes have a greater tendency to erode and wash away during rain events than soils on slopes of less than 15 percent. Because construction activities are discouraged on Fort Belvoir on these unstable slopes, these areas are designated as a severe land constraint. The Appling gritty loam, Dumfries sandy loam, Louisberg coarse sandy loam, Lunt fine sandy loam, and Quantico fine sandy loam units are considered to be steep. According to the soils information in the Fort Belvoir GIS, these units are not found within the family housing units.

4.5.1.3 Prime Farmland

Prime farmland soils are protected under the Farmland Protection Policy Act (FFPA) of 1981. The intent of the act is to minimize the extent to which federal programs contribute to the unnecessary or irreversible conversion of farmland soils to nonagricultural uses. The act

also ensures that federal programs are administered in a manner that, to the extent practicable, will be compatible with private, state, and local government programs and policies to protect farmland. The National Resources Conservation Service (NRCS) is responsible for overseeing compliance with the FPPA and has developed the rules and regulations for implementation of the act (see 7 CFR, Part 658, revised January 1, 1998).

According to the 1993 Master Plan, development in areas containing prime farmlands is allowed at Fort Belvoir due to the impracticality of farming on a military installation (US Army Garrison, 1993). Approximately 1,600 acres (19 percent) of Fort Belvoir's soils have been designated as "prime" farmlands. Map units that are complexes or associations containing components of urban land or miscellaneous areas as part of the map unit name cannot be designated as prime farmland. Twelve soils on Fort Belvoir have been identified as prime farmlands, four of which fall within the housing villages (20.5 acres total).

4.5.1.4 Seismic Activity

Major seismic activity is not a significant concern for buildings in Fairfax County.

4.5.2 Consequences

4.5.2.1 Proposed action

Geology, Topography, Prime Farmland, and Seismic Activity

No effects to geology, topography, prime farmland, or seismic activity would be expected from the proposed action.

Within currently developed areas, there will be some modification to some areas with slopes greater than 15%. These areas are small and independent sloping areas (most likely created during previous construction activities) that do not connect to larger riparian systems, typically located around the perimeter of these developed sites. Where this is the case, and the modification is needed to properly provide interconnected streets and a logical neighborhood framework, these small sloped areas may be regraded.

Within currently undeveloped areas, development on slopes greater than 25% will be avoided completely. Development of roads and buildings will be avoided on natural slopes between 15 and 25%, with a few minor exceptions: small increments of the eastern edge of the perimeter road in New South Post Village in areas needed to provide proper connectivity for the residents, and in isolated areas in increments of no more than 5,000 square feet where edges of roads or buildings may encroach.

The use of retaining walls will be explored and used in conjunction with other techniques to minimize grading and reduce impacts to vegetative plant communities within the footprint.

Areas designated as prime farmland are currently developed. Redevelopment will not cause adverse effects to these areas.

Soils

Both short-term minor adverse effects and long-term minor beneficial effects would be expected. Effects on soils would be limited to those areas within the villages where demolition of existing houses and new construction are expected.

In the short term, increased runoff and erosion would occur during site construction due to removal of vegetation, exposure of soil, and increased susceptibility to wind and water erosion. However, these effects would be minimized by the use of appropriate best management practices (BMPs) for controlling runoff, erosion, and sedimentation. (See Section 4.6 for a discussion of storm water management.)

In the long term, implementation of the proposed action would decrease soil erosion from storm water runoff through the creation of storm water BMPs. Although overall impervious areas will increase with the proposed action, water flowing from those surfaces would be routed to the storm water BMPs to prevent flooding, minimize erosion, and improve the quality of storm water before it is discharged to receiving streams and ultimately into Chesapeake Bay. (See Section 4.6 for a discussion of storm water management.)

4.5.2.2 No Action Alternative

Geology, Topography, Prime Farmland, and Seismic Activity

No effects would be expected.

Soils

No significant effects would be expected for soils under the no action alternative. Construction activities related to normal maintenance and repair of housing units would result in some disturbance to soils. Over time, erosion could result from the lack of stormwater management facilities in many of the existing housing villages under existing conditions.

4.6 Water Resources

4.6.1 Affected Environment

4.6.1.1 Surface Water

Fort Belvoir lies within the 64,000 square-mile Chesapeake Bay watershed. The Chesapeake Bay is a complex ecosystem that has received study by a variety of federal and state agencies. These studies have provided significant insight into the system's workings and into some of the reasons why the Bay has experienced adverse effects to water, sediments, and living organisms.

Fort Belvoir lies on the Potomac River, the second largest tributary to the Chesapeake Bay. Surface water resources on Fort Belvoir include Dogue Creek, Pohick Creek, Accotink Creek, Mason Run, several unnamed tributaries, groundwater seeps, three manmade ponds, Gunston Cove, and Accotink and Pohick Bays. (Wetlands are discussed in Section 4.7 – Biological Resources.)

The baseline watershed survey (US Army Garrison, March 2001) identified seven main watersheds on Fort Belvoir. Fort Belvoir's three largest watersheds originate off-post and discharge from Fort Belvoir: the Accotink Creek watershed, the Dogue Creek watershed, and the Pohick Creek watershed. The majority of water from within installation boundaries flows into these three watersheds. The remaining installation areas belong to four smaller on-post watersheds: the Accotink Bay watershed, the Pohick Bay watershed, the Gunston

Cove watershed, and the Potomac River watershed. These watersheds drain directly into these four water bodies without first entering Accotink Creek, Dogue Creek, or Pohick Creek. These major watersheds have been subdivided into a total of 52 subwatersheds (Figure 4-4).

DoD and the Department of the Army (DA) became a partner in watershed management in the Chesapeake Bay by signing the commitments outlined in the Chesapeake Bay Program and federal agencies' agreements (U.S. DoD, 1998). The Chesapeake Bay Restoration Act of 2000 amends the Federal Water Pollution Control Act to assist in the restoration of the Chesapeake Bay. The Chesapeake Bay Restoration Act of 2000 requires federal agencies that own or operate a facility within the Chesapeake Bay watershed to participate in regional and subwatershed planning and restoration programs. In addition, the Act requires federal agencies that own or occupy real property in the Chesapeake Bay watershed to ensure that the property, and actions taken with respect to the property, comply with the Chesapeake Bay Agreement, the Federal Agencies Chesapeake Ecosystem Unified Plan, and any subsequent agreements and plans. (US Army Garrison, March 2001).

The 1987 Chesapeake Bay Agreement set forth specific goals in a number of areas, including water quality. Most recently, the Chesapeake Bay Program partners signed a new Bay agreement designed to renew the historically significant 1987 agreement. This new agreement, Chesapeake 2000, guides the Chesapeake Bay Program partnership from 2000 until 2010. Fort Belvoir views these agreements, as the "overarching definers of its water resources management program. The agreements consider and integrate all of the forces influencing water resources management through initiatives addressing water quality and living resources" (US Army Garrison, March 2001).

In addition, as detailed in Section 4.7, the Coastal Zone Management Act of 1972 requires that federal projects that affect land uses, water uses, or coastal resources of a state's coastal zone must be consistent to the maximum extent practicable with the enforceable policies of that state's federally approved coastal zone management plan.

Fort Belvoir currently holds a Phase I VPDES permit for storm water discharges from industrial activity at Davison Army Airfield. The installation will also be covered under a general Virginia Pollutant Discharge Elimination System (VPDES) Phase II Storm Water permit as a regulated small municipal separate storm sewer system (MS4). The VPDES Phase I permit program also governs any construction activity including clearing, grading, and excavation activities, except for operations that results in the disturbance of less than 5 acres of total land area that is not part of a larger common plan of development or sale (Gillett, personal communication, June 2003). The Phase II VPDES program expands permit coverage to storm water discharges from construction activity that results in the disturbance of total land area of 1 acre or more.

The Chesapeake Bay Preservation Area Designation and Management Regulations (CBLAD, 2002) and the related Fairfax County Chesapeake Bay Preservation Ordinance (Fairfax County, 2003) restrict development within Resource Protection Areas (RPAs) and Resource Management Areas (RMAs). RPAs are defined by CBLAD as all tidal and contiguous non-tidal wetlands and perennial water bodies, plus a buffer of 100-foot width, landward of these features. In addition Fairfax County has included all land within the designated major floodplains as part of the RPA. Fairfax County is currently delineating the perennial/

intermittent boundary for all of the streams in the County based on newly developed field assessment protocols in an effort to define the perennial streams, for use in determining RPA boundaries.

Fairfax County expanded the protection provided through the RPA regulations, to include a variable width buffer around environmentally sensitive areas associated with streams, based on topographic slope and habitat quality. These buffers are defined in the Fairfax County Environmental Quality Corridor Policy. Fort Belvoir and its selected partner have agreed that the new development and re-development projects will be consistent with the Environmental Quality Corridor Policy, to the extent practicable.

ENRD conducted a installation-wide stream survey in 2001-2002, and submitted the perenniality designations that resulted from the survey to the U.S. Army Corps of Engineers (USACE). The stream channels were divided into four categories: perennial, intermittent, ephemeral, and storm channel. These delineations will be verified, using the Perennial Stream Field Identification Protocols (Fairfax County, 2003) to ensure consistency with the Fairfax County program. Table 4-9 summarizes the approximate length of each stream type located within each village footprint, based on the Fort Belvoir delineation. The majority of the channels within the proposed village footprints are storm channels, and these are considered to provide a marginal service.

TABLE 4-9
Linear Feet of Stream in Each Village Footprint

	Perennial Channel	Intermittent Channel	Storm Channel	Total
Belvoir Village	42	438	1547	2027
Colyer Village			373	373
Dogue Creek Village	45	171	3928	4144
Fairfax Village			474	474
George Washington Village	819	100	1824	2743
Gerber Village				
Jadwin Village		272	1112	1384
Lewis Heights Village		50	152	202
Park Village			869	869
River Village			897	897
Rossell Loop Village		22	768	790
Woodlawn Village			12,718	12,718
New South Post Village	1169	553	2035	3757

TABLE 4-9
Linear Feet of Stream in Each Village Footprint

	Perennial Channel	Intermittent Channel	Storm Channel	Total
Total	**2075**	**1605**	**26,697**	**30,377**

Note: Stream lengths are based on stream perenniality delineations in 2000 and 2001 by Performance Group Incorporated for DPW&L[3]-ENRD. These delineations and the locations of wetlands contiguous and connected by surface flow to perennial streams will be verified through field assessments prior to final design.

Based on the current RPA coverage from Fairfax County, Ft Belvoir has approximately 1,700 acres of land designated as RPA (Figure 4-4). The limits of the RPA currently include approximately 14.2 acres in the middle of River Village, 2.4 acres at the north end of George Washington Village, and 3.3 acres along the western boundary of Woodlawn Village. In addition, small areas associated with Building 409 in Rossell Loop Village, Building 67 and its associated detached garage in Belvoir Village, and Building 937 in Dogue Creek Village are also located within the RPA. Based on the current Fairfax County RPA coverage, the approximate impervious surface within the RPA, under existing conditions is summarized in Table 4-10 for each village.

TABLE 4-10
Existing Impervious Cover within the RPA

	RPA Area (acres)	Impervious in RPA (acres)	Percent Impervious in RPA
Belvoir Village	0.8	0.2	25
Dogue Creek Village	0.9	0.2	22
George Washington Village	2.4	0.85	37
River Village	14.2	5.1	36
Rossell Loop Village	0.1	0.0	0
Woodlawn Village	3.3	0.6	18
Proposed New South Post Village	0.2	0.0	0

Note: Data based on current Fairfax County RPA Layer. Stream pereniality will be verified through field assessments and RPA boundaries will then be adjusted, prior to final design.

The remaining housing villages (including the proposed New South Post Village) and the two construction support sites lie outside of the RPA. The Fort Belvoir stream mapping identifies some segments of perennial stream that are currently not included within the Fairfax County RPA and some segments of intermittent streams or storm channels that are included within the RPA. New field surveys will confirm stream perenniality and formally delineate the RPA. It is likely that an additional RPA area will be added within the New South Post Village as a result of this process.

[3] Formerly DIS (Directorate of Installation Support)

Additional land areas, identified as environmentally sensitive due to site-specific land characteristics (erodible soils, steep slopes, etc.), can be designated as RMAs. Most of Fairfax County (including all of Fort Belvoir) has been designated as a RMA.

Most of the storm water runoff from the villages proposed for redevelopment is currently collected in a curb and gutter system and discharged directly to the stream channels. The original construction of the villages predated any storm water management regulations requiring post-construction detention of storm water. There are two villages, for which there are stormwater management facilities. Most of the runoff from Woodlawn Villages is treated through multiple ponds located around perimeter of the village. Also portion of the stormwater from Lewis Heights Village is treated in a pond, along with the runoff from the adjacent Child Development Center. In recent retrofit opportunities, the ENRD has also installed risers in two locations in an attempt to temporarily pond water and protect the channels downstream. One riser was located outside New South Village, on the south side of 9th Street, and a second south and west of Gerber Village, off Gunston Road. ENRD has also installed outlet protection in several locations.

4.6.1.2 Groundwater

Fort Belvoir is underlain by three main groundwater aquifers: the lower Potomac, middle Potomac, and Bacons Castle Formation. The lower Potomac aquifer is the primary aquifer in eastern Fairfax County and on the installation. This aquifer exists between a layer of crystalline bedrock and a thick wedge of clay. Water in the lower Potomac aquifer flows to the southeast and is recharged in the western section of Fort Belvoir and to the north and west of the installation (US Army Garrison, March 2001). Water from this aquifer below Fort Belvoir is potable, however it is not currently a drinking water source. Any abandoned potable wells on the post have been closed and filled over the last 2 years. Additionally, there are five groundwater wells used for irrigation purposes, four at the North Post golf course and one at DLA (Bolton, June 25, 2002).

The middle Potomac aquifer consists of inter-fingering lenses of medium sand, silt, and clay of differing thickness. The middle Potomac confining unit is not present in the Fort Belvoir area. Water flow in the middle Potomac aquifer has not been well studied. The Bacons Castle Formation is the shallowest aquifer in the North and South Posts. This aquifer's flows are localized, originating from various recharges on the installation and draining to nearby streams, creeks, and large surface water bodies (US Army Garrison, March 2001).

Although the water table fluctuates based on precipitation, leakage, and evapo-transpiration, depth to the water table at Fort Belvoir is typically 10 to 35 feet below the ground surface. However, in some areas, fine-grained sediment (e.g., clay or fine silt) with low permeability is present in the subsurface, creating isolated local or regional confining layers. These confining layers may locally restrict vertical movement of ground water. The water table may be at or near the surface in areas near streams. Under saturated conditions, artesian wells (in which water rises to the surface) have been encountered at Fort Belvoir. This suggests that shallow groundwater flow closely relates to surface drainage features (US Army Garrison, March 2001).

4.6.1.3 Floodplains

Floodplains are important as a physical feature of the landscape, as a master planning designation for conservation of certain resource values, flood insurance planning, and as a regulatory designation for Executive Order (EO) 11988 (Floodplain Management), National Flood Insurance Program and Fairfax County Zoning Ordinance. From a planning perspective, EO 11988 sets forth the responsibilities of federal agencies in reducing the risk of flood loss or damage to personal property, minimizing the impact of flood loss, and restoring the natural and beneficial functions of floodplains. Under this order, Fort Belvoir is required to evaluate potential effects of any action occurring in a floodplain.

Floodplain and RPA management has primarily involved avoidance during development planning. Within this environmentally sensitive designation, 100-year floodplains are considered a moderate constraint and RPAs are considered a severe constraint. Moderately constrained areas are considered to be compatible only with lower intensity development, and must be thoroughly investigated before development. Severely constrained areas have the greatest degree of limitation, and are compatible only with very low-density or no development.

Fairfax County has mapped portions of the post. The 2003 Fairfax County 100-year floodplain is shown in Figure 4-4. The FEMA flood insurance map was also reviewed for comparison purposes.

George Washington Village. 1.0 acres in the George Washington Village, north of Mt Vernon Road are located within the Fairfax County 100-year floodplain, as currently mapped. There are currently 2 houses (Buildings 1569 and 1570) and a segment of Statesman Road located within the Fairfax floodplain. According to Fairfax County staff, the study that produced the floodplain along Dogue Creek was conducted in 1958 and FEMA conducted a re-study in 1986. Fairfax County is currently evaluating the two studies to determine which one will be recognized by the County. The Base Flood Elevation (BFE) in the FEMA 100-year floodplain in this area is 10 ft in the National Geodetic Vertical Datum of 1929 (NGVD29) datum, and approximately 9 ft in North America Vertical Datum of 1988 (NAVD88) datum. This elevation is 2 to 3 feet lower than the Fairfax County Floodplain BFE, which is approximately 12 ft (NAVD88). Because the Fairfax floodplain is older and currently under review, it is assumed for the purpose of this EA that the FEMA floodplain is the appropriate floodplain in this area.

River Village. Approximately one-third of River Village (13.8 acres) is located within the current Fairfax County 100-year floodplain of Dogue Creek. Similar to George Washington Village, the FEMA and Fairfax floodplains differ somewhat, FEMA being several feet lower. Again, because the Fairfax floodplain is under review and the FEMA study is more recent, the FEMA floodplain elevation will be assumed.

Dogue Creek Village. Dogue Creek Village is located immediately adjacent to but not within either the FEMA or Fairfax 100-year floodplain of Dogue Creek.

Belvoir Village. A portion of Belvoir Village (0.2 acres), along the Potomac River is designated as the Fairfax County 100-year floodplain. The only impervious surface within the floodplain is a small portion of Patrick Road.

The remaining housing villages (including the proposed New South Post Village) and the two construction support sites lie outside of the 100-year floodplain.

4.6.2 Consequences

4.6.2.1 Proposed Action

Surface Water

Both long-term beneficial and short-term minor adverse effects would be expected for surface water as a result of storm water management during and after the construction of new housing villages. The proposed action will first and foremost avoid impacts to stream channels where practicable through proper development planning. As detailed in section 4.5 Geology and Soils, the plans minimize development on slopes of greater than 15 percent, reducing erosion problems and its corresponding effect on water quality. In addition, where perennial streams remain near (or within) the village footprint boundary, development will be conducted in accordance with the Fairfax County Chesapeake Bay Preservation Ordinance and Environmental Quality Corridor Policy, in order to minimize impacts on the existing stream buffer. The increased impervious surface outside the RPA that will result from this action will be mitigated through standard storm water management practices, to meet the minimum standards and specifications in the Fairfax County Public Facilities Manual. Where practicable, infiltration-type storm water management practices will be implemented, in an attempt to more closely mimic the hydrology of a vegetated site and reduce the impacts of concentrated flows.

FBRC will evaluate the stream channels within the footprints, using the Fairfax County Perennial Stream Field Identification Protocols, to verify current stream designations. FBRC will also work with the Army Corps of Engineers, during wetland delineations, to identify any waters of the U.S., including jurisdictional wetlands and streams, within the footprints. The site plans will be modified, where practicable to avoid and minimize impacts to any waters of the US and to minimize impacts to intermittent or perennial streams. Mitigation for unavoidable impacts will be determined, in consultation with USACE, VDEQ and DPW&L-ENRD. Mitigation may include restoration and enhancement of stream channels and upland buffers, within the impacted subwatershed and within the installation to the extent practicable. At a minimum the storm water function of the impacted channels will be replaced through proper storm water management and outlet protection.

The proposed action is not expected to have significant direct impact to the streams on the installation, with one exception. There is one 530 foot stream channel that is currently designated as intermittent that drains a portion of the New South Post Village. The high density development in New South Post prevents the potential for entirely avoiding this channel. Approximately 150 feet of the channel will be preserved within the RPA buffer around the downstream perennial channel. The remaining 380 feet is likely to be piped. Mitigation for this impact will be determined through the process defined above.

There are two stream channels within the footprints that are currently designated as perennial. The 820 foot channel in George Washington village currently drains through the village in a large storm drain. This pipe will not be modified, therefore no impact is anticipated. The 1170 foot perennial channel through the New South Post Village will be maintained, with a 100-ft natural forested RPA buffer, therefore no impact is anticipated.

Although this is not currently part of the Fairfax RPA map, it is anticipated that field evaluations will result in an RPA through this area. All other streams currently designated as perennial or intermittent are small segments along the periphery of the footprints, and are not expected to be impacted by this action.

There are approximately 27,000 linear feet of storm channel that have a potential to be impacted by this action. The storm channel designation is an indication that these channels do not currently provide significant biological value, therefore they will be adjusted and moved as needed for this action, and proper storm water management and outlet protection will be provided to replace the storm water function of the channels.

No significant impacts to the RPAs are expected. Currently, significant portions of River Village and George Washington Village and small sections of several other village footprints are located within the current Fairfax County RPA. In Fairfax County, development within the RPA is regulated through the Chesapeake Bay Preservation Ordinance. The intent of the ordinance is to prevent clearing in the RPA as a result of new development, and to prevent additional encroachment or increase in impervious surface within the RPA for re-development projects. There are some exceptions, such as road or driveway crossings, flood control or storm water management facilities (Fairfax County, 2003). Based on the current Fairfax County RPA coverage, the approximate impervious surface within the RPA under existing conditions is summarized in Table 4-10 for each village. As noted previously, field assessments will be conducted by FBRC to determine stream perenniality and delineate wetlands contiguous and connected by surface flow to perennial streams. The results of the field assessments will be used to revise RPA boundaries. The site plans will then be modified to ensure consistency with the Fairfax County Chesapeake Bay Preservation Ordinance. Because Fairfax County ordinances do not apply to federal property, in lieu of the County's review process for exceptions, any exceptions and resulting mitigation requirements for the RCI project will be coordinated with ENRD and will be reviewed and approved by the Garrison Commander, on a case-by-case basis. No significant impacts to the RPA are anticipated.

FBRC will also review the sites, after completion of field surveys, for consistency with the Fairfax County Environmental Quality Corridor Policy. Site plans will be modified to the extent practicable to protect high quality habitats or sensitive areas identified.In addition to preservation of the 100-foot RPA buffers on perennial streams and wetlands contiguous and connected by surface flow to perennial streams, required by the Fairfax County Chesapeake Bay Preservation Ordinance, a vegetated buffer of up to 25 feet from the top of bank around intermittent streams and ecologically significant ephemeral streams and wetlands, will be maintained to the extent practicable.

The entirety of Fort Belvoir is located within the RMA. General statewide and local storm water regulations are applicable in these areas. As described in Section 4.6.1.1, these regulations require storm water management controls if there is an increase in impervious cover. The approximate amount of impervious area within each village (including the RPA) was computed based upon preliminary designs. The proposed action will increase impervious surface in all of the villages at which there are proposed changes. The percent impervious surface within the impacted areas will increase by 36 percent over existing conditions from 24 percent impervious surface to 33 percent. The largest change was in the

New South Post Village, where there are currently no buildings. Table 4-11 shows changes to impervious surface for each village.

The current percent impervious surface for each subwatershed impacted by the proposed action, and a list of villages that are at least partially located in each subwatershed is summarized in Table 4-12. The proposed changes are difficult to quantify because siting plans are not yet final; therefore a qualitative evaluation was conducted. The largest increases appear to be in Subwatersheds 03, 14, 19, 22, 24, and 34. The majority of these subwatersheds are currently between 18 percent and 20 percent impervious surface. Subwatershed 22 is at 22 percent and subwatershed 34 is at 28 percent impervious.

TABLE 4-11
Comparison of Impervious Cover by Village

	Existing		Proposed		Change	
	Acres	**Percent**	**Acres**	**Percent**	**Acres**	**Percent**
Belvoir Village	10.7	17	13.0	21	2.3	21
Colyer Village	4.8	32	6.1	41	1.3	27
Dogue Creek Village	13.6	32	13.6	32	0.0	0
Fairfax Village	9.7	23	12.8	31	3.1	32
George Washington Village	13.4	30	14.4	32	1.0	7
Gerber Village	9.5	27	10.8	31	1.3	14
Jadwin Village	6.5	22	8.0	28	1.5	23
Lewis Heights Village	17.6	37	21.3	45	3.7	21
Park Village	3.6	25	4.6	32	1.0	28
River Village	12.7	34	12.7	34	0.0	0
Rossell Loop Village	5.2	28	7.4	40	2.2	42
Woodlawn Village	35.7	23	44.3	28	8.6	24
Proposed New South Post Village	10.4	13	39.1	49	28.7	278
Project Total	**153.4**	**24**	**208.1**	**33**	**54.7**	**36**

There is evidence to indicate that impervious cover can directly relate to stream conditions (Schueler and Holland, 2000). According the Schueler and Holland (2000) streams with less than 10 percent impervious surface are considered relatively unimpaired, those between 10 and 25 percent are stressed, and those greater than 25 percent are considered impaired.

During final design, FBRC will review the impacts on total impervious cover in the subwatershed. Special attention will be paid to provide the most effective BMPs in any watersheds where impervious surface is nearing this 25 percent threshold. While several subwatersheds are expected to have notable increases in impervious surface, the additional storm water management that will be provided, is expected to mitigate for this impact.

In the short term, construction activities would increase surface erosion and increase the dissolved solid and sediment content in the storm water runoff water, in turn reducing water quality in the surface waters. However, storm water runoff during the construction phase in the villages and in the construction areas will be adequately controlled through implementation of a erosion and sediment control plan, consistent with the Public Facilities Manual of the County of Fairfax (Fairfax County, 2001) and the Virginia Erosion and Sediment Control Handbook (VDCR, 1992). Temporary erosion and sediment control such as silt fencing to trap waterborne sediments, and permanent measures, such as reseeding and revegetation and rip rap at storm water discharge points, will be used to minimize adverse effects on water quality and stream channel habitat. These procedures will be summarized in an Erosion and Sediment Control Plan. This plan, as well as the standard operating practices for construction, spill control and response, and inspection and maintenance procedures will be summarized in a SWPPP to reduce any surface water impacts. The proposed erosion and sediment control practices will reduce the sediment load in the runoff, however minor short-term effects are anticipated from this activity.

TABLE 4-12
Summary of Subwatersheds Affected

Subwatershed	Current Percent Impervious	Villages Included
03	18%	New South Post
04	31%	Temporary Construction; Gerber
05	16%	Temporary Construction
06	2%	Temporary Construction
10	7%	Temporary Construction
11	19%	Temporary Construction; Gerber
14	20%	Fairfax; Belvoir; Gerber
17	7%	Belvoir
18	12%	Belvoir
19	18%	Belvoir; Rossell Loop, Jadwin
20	3%	Jadwin
21	17%	Jadwin; Dogue Creek
22	24%	Dogue Creek; Park; New South
24	18%	New South Post; Colyer; George Washington
25	13%	Colyer; George Washington
26	10%	George Washington
27	12%	George Washington
30	17%	Lewis Heights
31	21%	Lewis Heights
33	8%	Woodlawn

TABLE 4-12
Summary of Subwatersheds Affected

Subwatershed	Current Percent Impervious	Villages Included
34	29%	Woodlawn

Storm water management Best Management Practices (BMPs) will be provided in all neighborhoods, developed or redeveloped, in the proposed action. After construction is complete, storm water runoff will be managed by installing and maintaining storm water management facilities designed in accordance with the Public Facilities Manual of the County of Fairfax (Fairfax County, 2001) and the Virginia Storm Water Management Handbook (VDCR, 1999). Where practicable, infiltration-type stormwater management practices will be implemented, in an attempt to more closely mimic the hydrology of a vegetated site, and reduce the impacts of concentrated flows.

Water quality BMP programs and facilities will be provided for all villages to achieve 40 percent decrease in phosphorous run off leaving the site. This will be achieved by a combination of devices designed into each neighborhood, typically including more than one of the following methods within each neighborhood; BMP methods may include:

- Infiltration Trenches - Infiltration trenches will be utilized throughout most or all the villages, based on wherever soil conditions are favorable.
- Bioretention - Bioretention facilities are landscaped shallow depressions that provide surface storage. Ponding depths are 6 inches or less, and are intended to drain within 48 hours.
- Amended Soil - Amended soil is used in narrow strips where space is limited. Planting soil to a depth of 18 inches is utilized. The area can be flat, have a slight slope or have a shallow depression. Plant with grass, trees, or shrubs.
- Infiltration below underground Storm Water Management - Additional volume will be provided in the gravel bed below the underground storm water management facilities in order to provide infiltration.
- Structural BMPs - Structural BMPs such as Stormceptor, Filterra, or Baysaver may be utilized for small areas where space does not permit the use of other treatments.
- Retrofit existing SWM facilities - Where feasible existing SWM facilities will be retrofitted to provide additional BMP benefits. Retrofits may include enlargement, modification of control structure, and addition of forebays or pretreatment.

Neighborhoods will also include quantity management facilities in order to meet the adequate outfall requirements of the Public Facilities Manual. This will be achieved by providing a total volume of storage equal to the volume required to provide extended detention for the 1-year 24 hour storm. Quantity management will be provided on a sub watershed basis, generally with one facility for each major outfall point. Some neighborhoods will have only one quantity control facility, while others will have more than one. Another goal will be to oversize the water quality BMP facilities in some areas, reducing the

1-year extended detention storage. This will provide the total storage volume required for 1-year 24-hour storm controls, but will reduce the size of the water quantity facilities. The overall result is better BMP quality controls while still providing 1-year extended detention controls. The 1-year storage will be provided in either surface ponds or underground facilities to be determined during final design.

Currently, in most locations, storm water discharges directly to the stream channel without any water quality or quantity improvements. Therefore, stormwater flows will be reduced and water quality will be improved, compared to existing conditions, in any areas where stormwater management is provided. As a result of this addition of water quality and quantity controls, the proposed action is expected to have a long-term beneficial effect on the surface waters.

A storm water management plan to manage the quantity and quality of stormwater runoff from the housing areas will be prepared and executed for the development and redevelopment of the housing areas. The installation will develop a storm water management plan as part of compliance with the Phase II Storm Water general permit as a regulated small municipal separate storm sewer system (MS4). The storm water management plan developed by FBRC will be modified, as necessary, to ensure consistency with the future installation-wide Storm Water Management Plan. The plan will include a description of the storm water management BMPs proposed as part of this project. Plans for inspection and maintenance of the storm water management facilities will be documented in the storm water management plan. The following aspects will be incorporated into the planning process:

- Minimal use of detention basins within the currently established neighborhoods. These facilities can have limited benefits to quantity and quality of storm water flows.
- Modern infiltration practices will be implemented that will allow storm water to infiltrate into the sandy soils.
- Drainage swales will be planted with native, wet tolerant plants to promote water quality through infiltration and/or filtration.
- Designs will allow for solids to settle from the storm water prior to discharge to streams

In addition to the storm water management plan, a SWPPP will be completed for any industrial facilities (e.g., maintenance shop) that may be constructed as part of the CDMP. The SWPPP will summarize standard operating procedures (i.e., spill response) and inspections needed to minimize future impacts to surface water and will be prepared in accordance with VDEQ VPDES regulations.

All impacts to storm water at the temporary construction support facilities will be limited to the duration of construction. Spill controls and erosion and sediment controls will be provided at these facilities and outlined in a SWPPP to minimize impacts to storm water quality. Because these control practices can not remove the entire pollutant load, these facilities may have a minor temporary impact to storm water quality, however the impact will not be significant.

If a concrete batch plant is utilized it will generate concrete wash out water as a byproduct. The wash out water contains suspended sediment particles causing the water to have high pH. A standard treatment system will be provided to clean the wash-out water, prior to discharge to the surface waters. A VPDES Phase I permit will be obtained, and all provisions of this program will be met to ensure no water quality impact from this discharge. Storm water runoff from this facility will be contained and treated through the same process.

A stone crusher will be installed at one of the two temporary construction sites. No process water will be utilized for the stone crusher; small quantities of water will be used to control dust, from which there will be no discharge. However, storm water runoff will be managed through standard erosion and sediment control practices. These practices will be specified in the Erosion and Sediment Control Plan.

Ground Water

Long-term minor beneficial effects would be expected on groundwater because of storm water management measures envisioned that will promote infiltration. This would be expected to have a positive impact on groundwater recharge.

Floodplains

No significant effects would be expected on the floodplains. Currently, only small portions of the existing housing areas are located within the FEMA 100-year floodplain. Under current National Flood Insurance Program and Fairfax County Zoning limitations, permanent dwellings are not permitted to be constructed within the 100-year floodplain, however some roadway and storm water facilities are permitted. The villages in the vicinity of the floodplains will be further evaluated with detailed topography to confirm the flood-plain boundaries. Because the Fairfax County definition of the RPA includes the 100-year major floodplains, and FBRC will commit to consistency with the Fairfax Chesapeake Bay Preservation Ordinance, there will be no increase in impervious surface in the floodplain areas.

There are no anticipated impacts to the floodplain in any of the affected villages. There are currently no changes to the grading or impervious surface within Dogue Creek. The action at River Village will be limited to demolition of the buildings down to the slab and foundation. Minor grading may be conducted to facilitate storm water runoff and prevent ponding. This action is not anticipated to have a significant impact on the floodplain. The only area within the floodplain in George Washington Village is a small segment of proposed road. This road will be evaluated for the possibility of raising the elevation above the floodplain if appropriate. None of the proposed buildings are inside this floodplain. In Belvoir Village there are not anticipated changes to Patrick Road, as it crosses through the floodplain, therefore there will be no impacts to the floodplain.

4.6.2.2 No Action Alternative

No significant effects would be expected on surface water as a result of continuation of current storm water management practices in conjunction with maintenance and repair of the housing within the existing villages. However, long term minor adverse effects would be expected, due to the lack of storm water management under existing conditions. Streams will continue to erode and adjust, creating steep and undercut stream banks, until a new,

stable channel alignment is reached. This process can continue indefinitely if the watershed continues to develop or if the stream can not find a stable equilibrium.

No effects would be expected on groundwater or floodplains under the no-action alternative.

4.7 Biological Resources

4.7.1 Affected Environment

4.7.1.1 Vegetation

Fort Belvoir has set aside 2,524 acres of relatively undisturbed land, including the Accotink Bay Wildlife Refuge, the Jackson Miles Abbott Wetland Refuge (JMAWR), and a Forest and Wildlife Corridor. In addition, there are large areas of undisturbed vegetation along steep slopes and stream valleys. The plant communities in these undeveloped areas at Fort Belvoir contain predominantly native species as compared to surrounding developed areas in Northern Virginia area where introduced invasive species often dominate.

Fort Belvoir's natural plant communities are highly influenced by the wide variety of landforms found on the installation, which include gently rolling plateaus, high bluffs that descend sharply into adjacent stream valleys, and tidal shorelines. Factors such as topographic location, soil, moisture, slope, and natural and human disturbances influence vegetation composition within each plant community type (US Army Garrison, 2002).

Vegetation along the edges of the existing housing villages consists of fringes of wooded areas. Vegetation within the villages consists mostly of landscaped trees, shrubs, and grasses with small pockets or clusters of trees existing in some villages. Based upon an aerial photograph of Fort Belvoir (November 2002), there are approximately 27 acres of heavily wooded areas and 44 acres of park-like land (mature trees with mowed grass and no understory) in the Proposed New South Post Village.

An installation wide vegetation study of Fort Belvoir conducted by Paciulli-Simmons identified the 16 community types, shown in the following table (US Army Garrison, September 2001). The survey also developed a floristic list of all plants occurring on the Main Post. Detailed descriptions of each of these communities including dominant vegetation and the list of plants on Fort Belvoir are provided in Appendix D. Table 4-13 and Figure 4-5 portray the vegetative communities present in each village.

TABLE 4-13
Vegetative Communities in Housing Parcels

Village	Community	Acres (Existing)
Belvoir	Beech Mesic – Mixed Oak Forest	0.3
	Oak Submesic – Ericad Forest	19.0
	Tulip Poplar Mesic – Mixed Hardwood Forest	1.2
Colyer	Beech Mesic – Mixed Oak Forest	0.1
	Oak Submesic – Ericad Forest	2.4

TABLE 4-13
Vegetative Communities in Housing Parcels

Village	Community	Acres (Existing)
Dogue Creek	Beech Mesic – Mixed Oak Forest	6.9
	Oak Submesic – Ericad Forest	2.0
	Tulip Poplar Mesic – Mixed Hardwood Forest	0.2
	Tidal Freshwater Marsh	0.02
Fairfax	Oak Submesic – Ericad Forest	14.7
George Washington	Beech Mesic – Mixed Oak Forest	3.6
	Tulip Poplar Mesic – Mixed Hardwood Forest	1.8
	Seeps (associated with Forested Wetlands)	0.5
Gerber	Landscaped throughout village	N/A
Jadwin Loop	Beech Mesic – Mixed Oak Forest	0.8
	Oak Submesic – Ericad Forest	6.0
Lewis Heights	Tulip Poplar Mesic – Mixed Hardwood Forest	0.5
Park	Beech Mesic – Mixed Oak Forest	1.1
	Oak Submesic – Ericad Forest	1.8
River	Landscaped throughout village	N/A
Rossell Loop	Beech Mesic – Mixed Oak Forest	0.7
	Oak Submesic – Ericad Forest	3.4
Woodlawn	Beech Mesic – Mixed Oak Forest	3.3
	Loblolly Pine Forest	3.9
	Mixed Pine-Hardwood Forest	3.1
	Old Field Grassland	3.3
	Tulip Poplar Mesic – Mixed Hardwood Forest	4.6
	Virginia Pine Forest	2.4
New South Post	Beech Mesic – Mixed Oak Forest	10.1
	Mixed Pine-Hardwood Forest	4.6
	Tulip Poplar Mesic – Mixed Hardwood Forest	3.4
Construction Site 1	Oak Submesic – Ericad Forest	0.002
Construction Site 2	Beech Mesic – Mixed Oak Forest	0.8
	Mixed Pine-Hardwood Forest	0.9
	Oak Submesic – Ericad Forest	2.1

Note: Detailed descriptions of each of these communities are provided in Appendix D.

Three tree surveys identifying the location, species, age, and health of each tree have been conducted at Fort Belvoir between 1998 and 2000. These surveys identify up to 2000 trees in the existing village which are considered to be mature, historical, or significant trees.

4.7.1.2 Wildlife

The Accotink Bay Wildlife Refuge, the JMAWR, the Forest and Wildlife Corridor, and other undeveloped areas of Fort Belvoir, such as stream valleys and slopes, are home to numerous wildlife species. Based on information from installation-wide surveys that were conducted for the preparation of the Fort Belvoir INRMP (Ernst and Miller, 1997; Ernst and Belfit, 1997 in US Army Garrison Fort Belvoir, March 2001), the installation contains potential habitat for any one of 42 species of mammals, 260 species of birds, 32 species of reptiles, and 27 species of amphibians.

In general, the housing villages are edged by wooded areas, some with steep ravines. A variety of wildlife species including mammals, amphibians, reptiles, and birds live in the wooded areas surrounding the housing villages. Substantial habitat, other than fringe woods, does not presently exist inside the villages. Existing and proposed housing villages are characteristically suburban settings. Therefore, wildlife in these areas primarily consist of species typical to residential settings such as squirrel, deer, and raccoon. Presence of the species can be both positive (wildlife watching) and negative (deer browsing on landscaped vegetation). Because some of the housing villages are adjacent to the Potomac River and other natural areas on-post, migratory birds species can be observed in and near the housing areas.

Species of management concern near the housing villages at Fort Belvoir include raccoons (*Procyon lotor)*, woodchucks (*Marmota monax)*, beavers (*Castor canadensis*), striped skunks (*Mephitis mephitis*), house mice (*Mus musculus*), Norway rats (*Rattus norvegicus*), and feral cats (*Felis domesticus*). FBRC will adopt the current Post policy regarding nuisance animal control. Residents are instructed to keep garbage picked up and stored inside until refuse pickup times.

Many of the bird species at Fort Belvoir are migratory birds. The Migratory Bird Treaty Act prohibits the taking, killing, or possessing of migratory birds. Under the act, it is unlawful, unless permitted by regulations, to pursue, hunt, take, capture, or kill; attempt to take, capture, or kill; possess, offer to sell, barter, purchase, deliver, or cause to be shipped, exported, imported, transported, carried, or received any migratory bird part, nest, egg, or product, manufactured or not.

A variety of aquatic species (27 species of amphibians, 60 species of fish, and 197 taxa of benthic invertebrates have been identified) have potential habitat in the streams that surround and run through Fort Belvoir.

A table of mammals, birds, fish, amphibians, and reptiles known or expected to occur at Fort Belvoir is located in Appendix E.

4.7.1.3 Rare, Threatened, and Endangered Species

The Endangered Species Act (ESA) of 1973 and subsequent amendments provide for the conservation of threatened and endangered species of animals and plants and the habitats in which they are found. The Department of the Army ensures that consultations are conducted as required under Section 7 of the ESA for any action that may affect a federally listed threatened or endangered species according to guidance in Army Regulation (AR) 200-3. The Army also complies to the extent practicable with state threatened and endangered species regulations.

A Natural Heritage Inventory of Fort Belvoir was performed by DCR-NHP in 1996. The inventory identified four rare plant species (velvety sedge (*Carex vestita*), vetchling (*Lathyrus palustris*), water plantain crowfoot (*Ranunculus ambigens*) and river bulrush (*Scirpus fluviatilis*)) and three watchlist plant species (creeping spikerush (*Eleocharis smallii*), blueflag (*Iris versicolor*) and giant bur-reed (*Sparganium eurycarpum*)). None of these rare or watchlist species occur within the housing areas.

The inventory identified six locations of significant vegetation communities, all of which are wetlands: three associated with Accotink Bay wetlands within the ABWR, two within the lower parts of two training areas, and one within Humphrey's Engineering Center. The 1996 DCR-NHP inventory defined the boundaries of two recommended conservation areas to protect these resources. A third conservation area, located in the vicinity of training area T-17, was recommended based on the results of a 1997 DCR-NHP zoological inventory. The recommended conservation areas are watershed-based and encompass large areas within Fort Belvoir. The ecological communities survey conducted in 2000, identified rare communities associated with groundwater seep areas near Dogue Creek, George Washington, and Rossell Loop Villages.

In 1994 and 1995, the Virginia Department of Conservation and Recreation, Division of Natural Heritage (VDCR/DNH) conducted a field survey for endangered, threatened, and state rare species at Fort Belvoir, concentrating on the most likely habitats to find rare species (US Army Garrison, March 2001). One species listed as both federally and state-threatened and one state-listed threatened species were identified. The first of these, the bald eagle *(Haliaeetus leucocephalu*s), has since been proposed for de-listing by the federal government, but is still listed as threatened. The shorelines of major creeks, rivers, and lacustrine areas on Fort Belvoir provide valuable nesting, foraging, and loafing habitat for resident and migratory bald eagles.

Fort Belvoir has implemented a USFWS- and VDGIF-approved Bald Eagle Management Plan (BEMP). The BEMP has been incorporated into the installation's INRMP. The BEMP establishes eagle management zones to protect nest and foraging habitat on the installation Eagle foraging areas are shown on Figure 4-6. Land use restrictions in the eagle foraging areas include no additional land clearing, no timber clear cutting, no land-disturbing training activities, no shoreline training activities, and no recreation other than fishing, hunting, and low-intensity passive recreation. In addition, management actions such as measures to prevent electrocution hazards and developing and implementing eagle awareness for residents have been implemented. Eagle management is a function of the ENRD, which coordinates closely with USFWS and VDGIF on eagle management.

Portions of the project area fall within designated bald eagle foraging areas along Fort Belvoir's shoreline of the Potomac River and Dogue Creek. Two active bald eagle nests are located on Fort Belvoir. One of the nests is located adjacent to one of the existing housing areas.

The state-listed threatened wood turtle *(Clemmys insculpt*a) has been documented on Fort Belvoir. The wood turtle inhabits forested floodplains and nearby fields, wet meadows, and farmlands. Because this species over-winters on the bottoms of creeks and streams, a primary habitat requirement is the presence of water (US Army Garrison 2002; TAMS, July 2002). There is an established population of these turtles at Huntley Meadows Park,

northeast of the JMAWR. There have been three wood-turtle sightings within Fort Belvoir in the last 4 years, indicating that this species may have become established on the Installation. Sightings occurred along the shoreline of Dogue Creek in 1998 near the JMAWR, along the shoreline of Accotink Creek near U.S. Route 1 in 1998, and about 75 feet north of the Accotink Bay Wildlife Refuge, at the Poe Road bridge in 1999. None of the sightings occurred within or near the housing parcels.

A survey for the wood turtle was conducted by Dr. Joseph Mitchell on Fort Belvoir between April and June of 2002. The survey evaluated the three major watershed on Fort Belvoir (Accotink Bay, Dogue Creek, and Pohick Bay) and divided the areas into three categories; suitable, unsuitable, and marginal). Streams in habitat areas designated as marginal or suitable were trapped in May and June. During the surveys, five species of freshwater turtle were found, however no wood turtles were located. Woodlawn Village is the most likely area of the installation where wood turtle might be encountered, because it is adjacent to Huntley Meadows Park, however, the habitat within the housing footprint was not considered to be highly suited. The conclusion of the investigation was that wood turtles were likely historical residents on Fort Belvoir, however, no viable wood turtle populations have been residents in recent times.

The peregrine falcon *(Falco peregrinu*s) is a state-listed endangered species. The peregrine falcon occurs along the Accotink Creek/Accotink Bay stream corridor during fall migration. This area of Fort Belvoir provides valuable foraging habitat for migratory falcons. Falcons have been recorded on Fort Belvoir during fall migrations (six sightings in 1998, four in 1999, and three in 2000). Potential threats to the peregrine falcon foraging habitat include disturbances near the shoreline, shoreline development, and waterfowl hunting. There are no housing parcels located along Accotink Creek shoreline. The construction support sites are located on the plateau east of Accotink Creek, but are not along the shoreline.

The Northern Virginia well amphipod *(Stygobromus phreaticu*s) was first discovered during surveys at Fort Belvoir conducted by VDCR-NHP from April 1996 through October 1996. This was the first known sighting of the amphipod since its collection from wells in Vienna, VA, in 1941 and Alexandria, VA, in 1948. Little is known about the amphipod; it is not state or federally listed but is referred to as globally rare. According to "*Ecology and classification of North American Freshwater invertebrates*" (1991) cited in the Fort Belvoir INRMP, this species may be particularly sensitive to groundwater contamination and pollution as well as withdraw of water from subterranean habitats (US Army Garrison, March 2001). The amphipod was discovered in a ravine in the southern peninsula of Fort Belvoir. This area is not located within the housing parcels; however, it is in the vicinity of the construction support areas and Gerber Village. This species is under consideration for listing by the U.S. Fish and Wildlife Service (USFWS) having been petitioned for Emergency Listing under the Endangered Species Act approximately 2 years ago. USFWS requires that, as part of the NEPA assessments for the RCI Program, Fort Belvoir perform an evaluation of the potential for project construction and operation to impact this species. Such an evaluation requires aquifer testing and zoological survey. Results of this survey are expected to be available in June 2003.

Agency Correspondence

According to correspondence with the USFWS dated October 3, 2002, occurrences of small whorled pogonia *(Isotria medeoloide*s), which is federally and state-listed as threatened, have been documented in Prince William County. As appropriate habitat for this species potentially exists on Fort Belvoir, the USFWS recommends that a survey be conducted within appropriate habitat between June 1 and July 20 of any given year, to determine the presence or absence of this species prior to any construction activities. Suitable habitat for this diminutive orchid is "very ordinary looking third-growth upland forests on terrain that is almost level or gently to moderately sloping in northerly or easterly directions. The understory is distinctly open, and flecks of sunlight play on the forest floor throughout the day. Some and perhaps all of the colonies occur on land that has been previously cultivated. Soils are acidic sandy loams with low to very low nutrient contents by agricultural standards." (US Army Garrison, 2002; TAMS, July 2002)."

[Preparer's Note: Request for information regarding essential fish habitat or other marine resources was sent to the National Marine Fisheries Service on April 1, 2003. A response has not yet been received. See Appendix F for correspondence.]

Correspondence with the Virginia Department of Game and Inland Fisheries (VDGIF, September 11, 2002) confirmed the potential for the federally and state-listed threatened bald eagle and the state threatened wood turtle to occur at Fort Belvoir. In addition, VDGIF noted that there are documented occurrences of alewife (*Alosa pseudoharengus*), striped bass (*Morone saxatilis*), and blueback herring (*Alosa aestivalis*) in stream reaches near the housing villages and recommended that Fort Belvoir coordinate with VDGIF regarding potential impacts to these species prior to construction. Anadromous fish surveys conducted by the Army on and around Fort Belvoir indicate that alewife, striped bass, and blueback herring occur in the larger waterways adjacent to Fort Belvoir (e.g., Potomac River, Dogue Creek, Gunston Cove, Accotink Bay/Creek and Pohick Bay/Creek) and not within the small streams within and adjacent to the housing villages. Therefore, no further surveys for these species will be conducted for this project.

[Preparer's Note: Request for confirmation, that no additional consultation is required for the three fish species, from VDGIF was requested on April 1, 2003. A response has not yet been received. See Appendix F for correspondence.]

VDGIF also noted that the bridle shiner (*Notropis bifrenatus*), brown creeper (*Certhia americana*), great egret (*Ardea alba egretta*), and the yellow-crowned night heron *(Nyctanassa violacea violacea*), all species of state special concern, have been documented nearby. However, as this designation is not a legal description, further coordination is not necessary.

An installation wide survey for the wood turtle was conducted by Dr. Joseph Mitchell at Fort Belvoir in 2002. According to discussions on December 4, 2002 during an interagency meeting (USFWS, VDGIF, and VDCR) at Fort Belvoir and from an e-mail correspondence between Jeff Cooper (VDGIF) and Dorothy Keough (Fort Belvoir) on January 7, 2003, no further surveys are required for wood turtle. [See Appendix F for correspondence.]

According to correspondence from the VDCR dated May 12, 2003, this project is not believed to adversely affect natural heritage resources or any documented state-listed plants or insects.

Based upon correspondence with federal and state agencies, there are no known rare, threatened, or endangered plant or animal species residing in the project areas, with the possible exception of small whorled pogonia. Surveys for pogonia will be conducted in June 2003 on the parcels proposed for construction in the near term. Other parcels scheduled for construction in subsequent years will be surveyed later on, prior to their disturbance. According to a letter from USFWS dated June 18 June, 2003, the USFWS concurred with the approach being taken to protect the small whorled pogonia, provided that consultation is conducted prior to finalizing and proceeding with construction plans in any of the surveyed woodland areas which are found to support the species.

4.7.1.4 Wetlands

Activities in wetlands are regulated under Section 404 of the CWA and under state wetlands protection laws. In addition, wetlands protection and management applies to all Army facilities' engineering activities in accordance with AR 200-1 Environmental Protection and Enhancement, AR 200-3 Natural Resources – Land, Forest and Wildlife Management, and E.O. 11990 Protection of Wetlands. Army actions seek to avoid adverse impacts, strive to achieve no net loss of value or functions, protect existing and restore former wetlands, and target no net loss of wetlands on Army controlled lands.

Fort Belvoir completed a baseline inventory of the wetlands on Main Post in 1997 (Figure 4-7). The purpose of these planning surveys was to identify and map the general locations and types of wetlands on post. The surveys were not intended to serve as jurisdictional delineations. The baseline wetland surveys were accomplished by reviewing and interpreting aerial photography of Fort Belvoir. After this desktop analysis was completed, limited field surveys were conducted to ground truth the data.

Approximately 1,250 acres of wetlands were identified on Fort Belvoir's Main Post through the baseline wetland surveys. 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 (US Army Garrison, March 2001). A total of almost 18 acres of wetlands exist in seven of the thirteen villages, however, approximately 16.8 of these 18 acres are found in Woodlawn Village.

Wetlands associated with streams at Fort Belvoir are characterized by somewhat poorly-drained to very poorly-drained floodplain bottomlands and sloughs. The composition is variable, and they are generally located on hydric soils dominated by hydrophytic vegetation. The vegetative communities consists of a variable mix of pin oak (*Quercus palustris*), willow oak (*Quercus phellos*), green ash (*Fraxinus pennsylvanicus*), sycamore (*Platanus occidentalis*), red maple (*Acer rubrum*), river birch (*Betula nigra*), and sweet gum (*Liquidambar styraciflua*). The understory usually contains highbush blueberry (*Vaccinium corymbosum*) (Paciulli, Simmons and Associates, Ltd., 1998).

Seep forests are often open-canopy forests of groundwater-saturated flats and slopes, generally surrounded by mixed hardwood forests. They occur along slopes where groundwater flows to the surface. Characteristic species are red maple, black gum (*Nyssa sylvatica*), sweetbay magnolia (*Magnolia virginiana*), skunk cabbage (*Symplocarpus foetidus*), sensitive fern (*Onoclea sensibilis*), and royal fern (*Osmunda regalis*). Key indicators are large mats of skunk cabbage and other herbaceous wetland vegetation.

Vegetation composition in marsh and emergent wetlands is variable, consisting of emergents including arrow arum (*Peltandra virginica*), rice cutgrass (*Leersia oryzoides*), sedges (*Carex sp.*), rushes (*Juncus sp.*), smartweeds (*Polygonum sp.*), and swamp rose mallow (*Hibiscus moscheutos*). Common shrubs are buttonbush (*Cephalanthus occidentalis*), swamp rose (*Rosa palustris*), and swamp dogwood (*Cornus amomum*) (Paciulli, Simmons and Associates, Ltd. 1998).

The following is a description of wetlands found in each village. (See also Table 4-14.)

Woodlawn Village. The western and northern borders of Woodlawn Village lie immediately adjacent to the Jackson Miles Abbott Wildlife Refuge. The western limits of the village overlap approximately 0.47 acres of palustrine forested deciduous saturated (PFO1B) wetlands on the far western boundary of Woodlawn Village. Approximately 1.88 acres of palustrine emergent temporarily flooded (PEMA) wetlands fall within Plantation Drive, north of Pole Road. Approximately 14.41 acres of palustrine forested deciduous seasonally flooded (PFO1C) wetlands are found between the eastern segment of Plantation Drive and the eastern edge of Fort Belvoir's property line.

Rossell Loop Village. There are only 0.01 acres of palustrine forested deciduous temporarily flooded (PFO1A) wetlands in Rossell Loop Village. These wetlands are associated with the headwaters of a small stream that originates in the parcel.

Belvoir Village. There are 0.10 acres of PFO1A wetlands, and 0.001 acres of PFO1B wetlands in Belvoir Village. These wetlands are associated with the headwaters of small streams that originate within the village.

Colyer Village. There are 0.03 acres of PFO1A wetlands in Colyer Village. These wetlands are associated with the headwaters of a small stream that originates within the village.

Dogue Creek Village. There are 0.10 acres of PFO1A wetlands in Dogue Creek Village. These wetlands are associated with the headwaters of small streams that originate within the village.

George Washington Village. There are 0.08 acres of PFO1A wetlands, and 0.36 acres of PFO1B wetlands in George Washington Village. These wetlands are associated with the headwaters of small streams that originate within the village.

Jadwin Village. There are 0.05 acres of PFO1A wetlands in Jadwin Village. These wetlands are associated with the headwaters of small streams that originate within the village.

New South Post Village. There are approximately 0.31 acres of PFO1A wetlands in New South Post Village. These wetlands are associated with a small stream that originates in the parcel.

According to the baseline wetland survey and GIS mapping, there are no wetlands located in Fairfax Village, Gerber Village, Lewis Heights Village, River Village, or Park Village, or in either of the temporary construction support sites.

TABLE 4-14
Summary of Wetlands by Parcel/Village

Parcel/Village	Wetland Type	Acres (Existing)
Belvoir Village	PFO1A PFO1B	0.10 0.001
Colyer Village	PFO1A	0.03
Dogue Creek Village	PFO1A	0.10
Fairfax Village	--	--
Gerber Village	--	--
George Washington Village	PFO1A PFO1B	0.08 0.36
Jadwin Loop Village	PFO1A	0.05
Lewis Heights Village	--	--
Park Village	--	--
River Village	--	--
Rossell Loop Village	PFO1A	0.01
Woodlawn Village	PFO1B PFO1C PEMA	0.47 14.41 1.88
New South Post Village	PFO1A	0.31
Construction Site 1	--	--
Construction Site 2	--	--

Note: Based upon baseline wetland survey.

4.7.1.5 Coastal Zone Management

The Coastal Zone Management Act (CZMA) of 1972 (16 USC § 1451, et seq., as amended) provides assistance to states, in cooperation with federal and local agencies, for developing land and water use programs in coastal zones. Section 307 of the CZMA stipulates that federal projects that affect land uses, water uses, or coastal resources of a state's coastal zone must be consistent to the maximum extent practicable with the enforceable policies of that state's federally approved coastal zone management plan. The Commonwealth of Virginia has developed and implemented a federally approved Coastal Resources Management Program (CRMP) describing current coastal legislation and enforceable policies. Virginia's enforceable policies subject to federal consistency include commercial fishing; recreational fishing in freshwater tidal rivers; encroachments on subaqueous lands; encroachments on wetlands; encroachments on primary sand dunes; land-disturbing activities needing erosion and sediment control; actual or potential wastewater discharges; control of septic and other onsite domestic waste systems; coastal land management; and air pollution control. Virginia's coastal zone encompasses the eastern third of the state including the Chesapeake Bay and its tributary rivers. Therefore, all of Fort Belvoir and all housing parcels and construction support sites are considered to be within the jurisdiction of the CZMA.

4.7.2 Consequences

4.7.2.1 Proposed Action

Vegetation and Wildlife

Significant adverse effects to vegetation would be expected to occur due to the necessary removal of vegetation during the construction process prior to mitigation. However, in order to minimize impacts to vegetative communities (including contiguous tree stands and park/urban trees) a tree survey will be conducted prior to construction. This survey will be conducted by a qualified professional who will assess the species, age, size, and health of each tree. Every park tree and tree stand location within the footprint of the existing housing villages, the proposed New South Post Village, and the two construction sites will be surveyed. Drip lines and canopy edges will be identified.

After the survey is conducted, a list of possible trees to save and/or relocate within the plan will be identified by the development partner in concert with ENRD. Each home, garage and road location will be considered for opportunities to reduce tree and viewshed impacts. Impacts will be reviewed on a tree-by-tree and house-by-house basis prior to completing any of the final construction site plans in an attempt to reduce impacts to vegetative communities on Fort Belvoir.

In addition, as part of the effort to reduce impacts to existing vegetation, the following areas are expected to be removed from the land lease during the metes and bounds survey:

- portions of Belvoir Village that are located behind Buildings 34 through 39 that are undeveloped and that are not needed for future storm water management areas,
- a portion of Colyer Village that is currently used as a wooded buffer alongside an ephemeral stream,
- portions of George Washington Village that are on the southwestern boundary located near a small groundwater seep,
- portions of Jadwin Village that are located on the southeastern side that are undeveloped and that are not needed for future storm water management areas,
- portions of Lewis Heights Village that are located on the eastern side that are undeveloped and that are not needed for future storm water management areas,
- portions of Rossell Village that are currently undeveloped and on steep slopes, and
- portions of Woodlawn Village that are located on the far eastern side of Plantation Drive.

As discussed in Section 4.6, field surveys will be conducted to determine perenniality of streams within the housing villages. One-hundred-foot vegetated buffers around perennial streams (and vegetated buffers of up to 25 feet from top of bank around intermittent streams, ecologically significant ephemeral streams, and wetlands, to the maximum extent practicable) will be maintained and protected (see Section 4.6 for detailed discussions).

As discussed in Section 4.5, slopes of 25 percent or greater that are not currently developed, will be avoided during the construction process. Construction in areas with slopes of 15

percent or greater that are currently developed will be minimized to the extent practicable. In addition, a jurisdictional wetland delineation will be performed to identify all existing wetlands within the housing villages. Construction in wetlands will be avoided to the extent practicable and any unavoidable impacts will be compensated for. All of these measures, seek to minimize impacts to vegetation and vegetative communities at Fort Belvoir.

Based upon worst case scenarios, impacts to vegetation were determined by assuming that all vegetation within the existing housing villages, the proposed new housing village, and the two construction sites will be removed due to construction activities. The following table presents these impacts by community.

TABLE 4-15
Maximum (Worst Case) Impacts to Vegetation

Vegetative Community	Total Acres on Fort Belvoir	Acres in Housings Villages and Construction Sites	Percent Impacts
Beech – Mixed Oak Forest	1119	27.0	2.4
Loblolly Pine Forest	245	3.9	1.6
Mixed Pine – Hardwood Forest	198	7.7	3.9
Non-Tidal Freshwater Marsh/Beaver Pond	129	--	--
Oak Forest	1262	49.3	3.9
Old Field Grassland	233	3.3	1.4
Groundwater Seeps	37.1	0.5	1.4
Tidal Freshwater Marsh	33.6	0.02	0.06
Tidal Freshwater Scrub-Shrub	12.4	--	--
Tidal Freshwater Swamp Forest	38.5	--	--
Tulip Poplar – Mixed Hardwood Forest	989	11.7	1.2
Urban (Street and Park Trees)	2771	503	18.2
Virginia Pine Forest	514		0.5
White Pine Forest	6.3	--	--
Total	7589	609	8 percent of total vegetation

Tree surveys have been conducted in some areas of Fort Belvoir and identify up to 2000 trees in the existing villages which are considered to be mature, historical, or significant trees.

Despite all of the efforts to avoid impacts to vegetation described above, there will be an overall loss to the trees, shrubs, and grasses at Fort Belvoir from this project prior to mitigation (tree and shrub replacement). The proposed action has the potential to impact approximately 609 acres (8 percent) of a total of 7,589 acres across Fort Belvoir. This amount of impact would be a significant effect on the environment.

Proposed mitigation for these losses include tree replacement on Fort Belvoir at a 1:1 ratio for every lost tree over 6 diameter at breast height. All trees planted by FBRC must be approximately 2.5 inch caliper, nursery grown. Planting locations for the replacement trees will be chosen in coordination with ENRD and will consider such aspects as species requirements (i.e., soil types, hydrologic conditions, and light requirements) planned land use, and land use restrictions (i.e., utility easements). Trees planted by FBRC within the landscaped portions of the housing villages and individual yards will be included in the replacement tallies. FBRC will coordinate with ENRD in order to develop a landscape planting and maintenance plan which will include planting with native, non-invasive, non-exotic plants. FBRC will also coordinate with ENRD on all installation-wide initiatives for vegetation management, such as invasive and exotic vegetation control, as appropriate. After mitigation measures are employed, overall impacts to vegetation from this project are not expected to be significant. (Cumulative impacts from other planned/expected projects are assessed in Section 4.13.)

Replacement of mature trees with younger trees results in a loss of service to the environment (shade and cover and food for wildlife) from the time of removal until the time that the younger trees begin to provide equally beneficial services and benefits. However, trees are a renewable resource, and the younger replacement trees will provide these services at a lesser level as soon as they are planted and will continue to increase their services each year until they reach full maturity.

Based upon the site layouts presented in the 30 percent conceptual drawings, two areas have been identified as potential mitigation/reforestation sites. The first is in Jadwin Village. Existing buildings along the northern portion of the village are located adjacent to steep slopes. Development plans for Jadwin Village are to demolish these buildings and place the new buildings further south and away from the steep slopes. The area where the buildings currently stand has potential to be used as a site for reforestation as mitigation for losses. The second site is in the northeastern portion of Rossell Loop. The housing unit that is currently located in this corner will be demolished and another building will not be put within the same footprint. This area also has potential to be used as a site for reforestation as mitigation for losses.

Shade trees will be planted along new streets to reduce the heat-island effect. Any trees planted along streets, in yards, open areas and elsewhere in the new housing villages will count towards the final mitigation numbers of trees to be replaced. The appropriate use of BMPs, such as erosion control practices and tree protection devices at all proposed construction sites, would protect vegetation and habitat adjacent to the construction areas. In addition, any activity would be coordinated to minimize encroachment upon the RPAs and be consistent with Fort Belvoir's Integrated Natural Resources Management Plan. To reduce the amount of construction upkeep following construction activities, native trees and native drought-tolerant vegetation would be planted near homes, in parks, and in open spaces. Storm water management ponds would be planted with native species used by wildlife for forage and cover.

Therefore, after mitigation measures have been implemented, no significant adverse effects to vegetation are expected.

Impacts to stream channels due to construction activities will affect the fish, amphibian, and benthic invertebrate populations that live in these segments. Mitigation to compensate for stream impacts (see Section 4.6 for details) will also compensate for lost habitat if the impacts are significant. Based upon the 30 percent conceptual drawings, no impacts to perennial streams (where the majority of fish, amphibians, and benthic invertebrates are expected to spend most of their time) are expected. In addition, storm water and sediment and erosion control practices will be implemented to prevent adverse effects to the stream communities. Therefore, although minor short-term adverse effects to the fish, amphibians, and benthic invertebrates may occur, they are not significant, and mitigation for these species is not necessary.

Rare, Threatened, and Endangered Species

In accordance with the Army's policy on natural resource protection, construction activities will avoid impacts to the habitats of sensitive species. Therefore, no long-term adverse effects are expected for sensitive species. Short-term minor adverse effects would be expected to sensitive wildlife from noise generated during construction. (See Section 4.4 for a discussion of impacts from noise.)

Pursuant to the Fort Belvoir Bald Eagle Management Plan (Paciulli, Simmons & Associates, Ltd. 2000), bald eagle foraging areas will be protected by enforcing the 750-foot linear buffer from the shoreline inland (with the exception of previously disturbed areas). On March 12, 2003, Craig Koppie of USFWS, visited Fort Belvoir and confirmed the presence of an active bald eagle nest adjacent to one of the housing villages. To protect this nest, and in accordance with federal and state law and Fort Belvoir policy, the Army will establish and maintain a primary nest protection zone (750 feet) and a secondary nest protection zone (from 750 to 1,320 feet) around this new nest. The Army is coordinating with USFWS and Virginia Department of Game and Inland Fisheries (VDGIF) to develop the restrictions for these areas. Such restrictions will take into account that developed land uses already exist within those areas. They will include restrictions on activity within the protection zones during the breeding season, protection of the existing forest vegetation around the site, and establishment and maintenance of vegetated buffers. In addition, there will be no additional clearing of trees or vegetation in undisturbed areas within the designated Eagle Foraging Areas. Land that is currently cleared within the Eagle Foraging Area can be redeveloped. According to a letter from USFWS dated 18 June, 2003, the USFWS agree with the approach being taken to protect the bald eagle.

Construction is expected to begin in the proposed New South Post Village, Lewis Heights, and Rossell Village within the first few years after leasing. The Army will survey undisturbed wooded areas of those parcels in the summer of 2003 for small whorled pogonia. The remainder of the RCI parcels will be surveyed later, prior to their disturbance. Until these surveys have been completed, currently undisturbed wooded areas that might provide potential habitat for the small whorled pogonia will not be disturbed. A qualified biologist will be contracted to conduct these surveys. According to a letter from USFWS dated 18 June, 2003, the USFWS agree with the approach being taken to protect the small whorled pogonia.

Fort Belvoir is currently conducting a hydrological study and survey for the Northern Virginia well amphipod in the Tompkins Bay and T-17 areas, which are not in but are near

the project footprint. These surveys will potentially determine if the species is present in the southern area. The hydrological studies will determine the direction of groundwater flow in order to better assess impacts to the amphipod from development. Results from the surveys are expected to be available in June 2003. Construction in the southern peninsula of Fort Belvoir will not begin until the surveys are completed and consultations with USFWS are complete. According to a letter from USFWS dated 18 June, 2003, the USFWS agree with the approach being taken to survey for the amphipod.

Rock crushing facilities will be located at the southern construction support site, which is located approximately 1.5 miles from the location of the closest active bald eagle nest and 1,250 feet from the boundary with the bald eagle foraging area. Rock crushing activities will not be conducted on a regular basis. Materials will be stockpiled and run through the crusher only after large demolition periods (see Section 4.4 for additional information). Therefore, the noise generated from this facility is not expected to affect sensitive species.

In order to protect rare communities (such as those associated with groundwater seeps) adjacent to any housing villages, FBRC will coordinate with ENRD in order to preserve appropriate buffers around these communities. Storm water management practices will protect these communities from adverse changes in water quality, flow, and groundwater recharge.

Wetlands

Wetland impacts associated with construction are expected to be minor due to the maintenance of forested buffers associated with streams that contain the majority of the wetland systems. Long-term adverse effects are not expected because all impacts will be mitigated with compensation in the form of creation, restoration, or enhancement. In accordance with the Army's policy on natural resource protection, construction activities will seek to avoid impacts to wetlands to the extent practicable. Impacts are expected to be minimal because wetlands identified in previous wetlands reconnaissance have been avoided to the maximum extent practicable during site planning.

Prior to construction in Waters of the U.S., a jurisdictional wetland delineation of all housing villages and potential construction sites will be conducted and approved by USACE. Avoidance of wetlands will be the first priority; however, if avoidance of wetlands is not practicable, a Joint Permit Application will be submitted to the Virginia Marine Resources Commission, which will in turn be forwarded to USACE, VDEQ, and the Fairfax County Wetlands Board for review and comment. In order to compensate for the losses to wetlands, mitigation will be provided (in the form of creation, restoration, or enhancement) in order to meet the Army's policy of no net loss of wetlands on Army-controlled lands. All field work and permitting activities will be complete prior to construction. Mitigation of impacted wetlands will include an evaluation of the functionality of the lost wetlands and mitigation will include the replacement of these wetland functions on Fort Belvoir.

The following is a qualitative estimate of wetland impacts by village. (See also Table 4-14.) The estimates are based upon conceptual design layouts of each village that are subject to change. A jurisdictional delineation will be conducted at each parcel to assess the acres of existing wetlands and potential impacts to those wetlands as part of the federal and state permitting process.

Woodlawn Village. Based upon the conceptual village layout, there will be no impacts to wetlands at Woodlawn Village. All construction will occur within the boundary of the existing Perimeter Road, with the exception of some recreational areas (ball fields) which will be located in areas that are already cleared. In addition, housing layouts have been designed to be located further from existing wetland areas than existing houses, providing additional buffer to the wetland. As there is currently no development planned in the area east of the outer side of Plantation Drive, this area is expected to be removed from the land lease during the Metes and Bounds Survey.

Rossell Loop Village. Based upon the conceptual village layout, there will be no impacts to wetlands at Rossell Loop Village.

Belvoir Village. Based upon conceptual village layouts, there will be no impacts to wetlands in Belvoir Village. One-hundred-foot RPA buffers will be retained around the perennial streams and wetlands adjacent to Belvoir Village with the exception of existing developed areas, as detailed in Section 4.6 Water Resources. These buffers are expected to protect the wetlands associated with the streams.

Colyer Village. Based upon conceptual village layouts, there are potential impacts to portions of the 0.03 acres of wetlands located in this village.

Dogue Creek Village. Because Dogue Creek Village has been recently renovated, future plans will not be developed until the out years and conceptual drawings for Dogue Creek Village have not been developed. Therefore, it is outside the scope of this project and wetland impacts will not be assessed in this document. However, prior to any demolition or construction in Dogue Creek Village, a jurisdictional delineation will be conducted to assess the acres of existing wetlands and potential impacts to those wetlands as part of the Federal and State permitting process.

George Washington Village. Based upon conceptual village layouts, there are potential impacts to the wetlands located near the intersection of Soldier Road and Surveyor Road and to the wetlands located in the southeast corner of the village. In each wetland area the corner of one lot crosses the wetland boundary. Grading, routine maintenance (i.e. mowing), and construction activities will likely impact these areas. During the metes and bounds survey, areas of existing wetlands that are not within the development footprint are expected to removed from the land lease.

Jadwin Village. The frame houses in the northern edge of the village will be demolished and new townhouses will be constructed southward, further away from the existing ravine and therefore away from the wetlands associated with the streams in the ravine. Although there is potential to impact wetlands during this process, the location of the new houses will afford more of a buffer for the wetlands.

New South Post Village. The site will maintain a 100-foot forested buffer from the onsite stream channel that includes 0.31 acres wetlands. Therefore, no wetland impacts are expected for this site.

Because there are no known wetlands within Fairfax Village, Gerber Village, Lewis Heights Village, River Village, Park Village, or either construction support site, no wetland impacts are expected in these villages.

TABLE 4-16
Summary of Wetlands Impacts by Parcel/Village

Parcel/Village	Wetland Type	Acres (Existing)	Acres (Impact)
Belvoir Village	PFO1A PFO1B	0.10 0.001	0 0
Colyer Village	PFO1A	0.03	0.03
Dogue Creek Village	PFO1A	0.10	0.10
Fairfax Village	--	--	--
Gerber Village	--	--	--
George Washington Village	PFO1A PFO1B	0.08 0.36	0.08 0.36
Jadwin Loop Village	PFO1A	0.05	0
Lewis Heights Village	--	--	--
Park Village	--	--	--
River Village	--	--	--
Rossell Loop Village	PFO1A	0.01	0
Woodlawn Village	PFO1B PFO1C PEMA	0.47 14.41 1.88	0 0 0
New South Post Village	PFO1A	0.31	0
Construction Site 1	--	--	--
Construction Site 2	--	--	--

Note: Impacts estimated. Based upon conceptual drawings.

Coastal Zone Management. No adverse effects would be expected to occur within the Coastal Zone.

All storm water runoff will be collected and discharged to storm water systems designed using BMPs and that meet Fairfax County requirements for the Chesapeake Bay RMA (see Section 4.6 for a discussion of storm water management). The proposed action will not disturb Chesapeake Bay RPAs.

The standard operating practices for construction, erosion, and sediment controls, and inspection and maintenance procedures will be summarized in a SWPPP to reduce any surface water impacts. The proposed erosion and sediment control practices will reduce the sediment load in the runoff, however minor short-term effects are anticipated from this activity.

Based upon conceptual site drawings, there is potential for impacts to wetlands to occur, however, these impacts are extremely small, and all impacts will be mitigated.

Emission calculations based on Northern Virginia's nonattainment status of severe indicate that air emissions from proposed action would not exceed *de minimis* levels, and therefore no significant impacts to air quality are expected, though there will be increased emissions during the 8-year construction period.

4.7.2.2 No Action Alternative

Vegetation, Wildlife, Sensitive Species, Wetlands, and Coastal Zone Management. No effects to vegetation, wildlife, wetlands, sensitive species, or coastal zone management would be expected. Ongoing maintenance and repair activities will be conducted in a manner sensitive to these resources.

4.8 Cultural Resources

4.8.1 Affected Environment

4.8.1.1 Prehistoric and Historic Background

Fort Belvoir contains numerous significant cultural resources, including the Belvoir Manor ruins and Fairfax gravesite, that are listed on the National Register of Historic Places (National Register or NRHP); Thermo-Con House, Camp A.A. Humphreys Pump Station and Filter Building, and US Army Package Power Reactor, that are individually eligible for listing on the NRHP and are listed on the Virginia Landmarks Register; structures and landscapes that contribute to the NRHP-eligible and Virginia Register-listed Fort Belvoir Historic District; and hundreds of archeological resources that are eligible or potentially eligible for listing on the NRHP.

In 2001, the installation completed the Integrated Cultural Resources Management Plan (ICRMP) (US Army Garrison Fort Belvoir, February 2001). The ICRMP can be consulted for a detailed description of the prehistoric and historic background of the RCI project area. Additional information about specific resources is maintained in the Fort Belvoir Environmental and Natural Resources Division's geographical information system (GIS) planning layers. Unless otherwise indicated, all information in this section regarding cultural resources within the Area of Potential Effect for the RCI project was obtained from the ICRMP, the GIS, and personal communications from DPW&L-ENRD personnel.

4.8.1.2 Status of Cultural Resource Inventories and Section 106 Consultations

Federal agency actions must comply with the National Historic Preservation Act (NHPA) of 1966, as amended. The intent of the NHPA is to integrate consideration of historic preservation issues into the early stages of project planning by a federal agency. Accordingly, under Section 106 of the NHPA, the head of any federal agency having direct or indirect jurisdiction over a proposed federal or federally financed undertaking is required, before the expenditure of any federal funds on that undertaking, to account for its effects on any district, site, building, structure, or object that is included or eligible for inclusion in the National Register.

Section 110, as amended, of the NHPA directs federal agencies to establish a program to locate, inventory, and nominate to the Secretary of the Interior all properties under their ownership or control that appear to qualify for inclusion in the NRHP.

The cultural resources of Fort Belvoir have been surveyed using the National Register Criteria for Evaluation (36 CFR 60.4). Studies have identified more than 300 archeological sites at Fort Belvoir, many of which have been assessed as potentially eligible for listing on the NRHP but require further evaluation to determine their eligibility. In addition, a disturbance study and archeological reconnaissance of all previously unsurveyed and undisturbed areas has been completed. In 1994, the Virginia Department of Historic Resources confirmed that Fort Belvoir has satisfactorily completed the identification of archeological resources on the installation.

The Fort Belvoir Historic District contains 181 contributing and 17 noncontributing resources, including several of the family housing villages (see below). Recent surveys have recommended adding other buildings in the housing villages to an expanded historic district. Additional buildings and structures will continue to be evaluated under the Section 110 process as those resources approach the 50-year age of potential eligibility.

Together, the 2001 ICRMP and the GIS layers, which were prepared in conjunction with the ICRMP and are continuously updated, identify all of the post's known cultural resources. The ICRMP provides guidelines for the management of these resources. As recommended by the ICRMP, the Army is planning to conduct a historic cultural landscape survey of Fort Belvoir in the near future.

4.8.1.3 Architectural Resources

The Area of Potential Effect (APE) for architectural and cultural landscape resources for the proposed RCI action is defined as Belvoir, Gerber, Jadwin, Park, and Rossell Villages. Table 4-17 summarizes the status of the architectural resources within the APE, which date from the 1920s through 1950. The APE does not include the modern units in Woodlawn Village and the Capehart-Wherry neighborhoods that were built in the 1950s and 1960s. The Advisory Council's nationwide "Program Comment on Capehart and Wherry Era (1949-1962) Army Family Housing, Associated Structures, and Landscape Features" (Program Comment) has provided an Army-wide Section 106 review for all undertakings affecting Capehart and Wherry buildings and landscape features.

The 211 buildings (256 housing units and 11 garages) proposed for transfer in Belvoir Village, Gerber Village, Jadwin, Park, and Rossell Villages have been determined to be eligible or potentially eligible for listing on the National Register, as contributing buildings to the Fort Belvoir Historic District (see Table 4-17 and Figure 4-8).

TABLE 4-17
Historic Housing Involved in RCI

Village	Number and Type of Buildings	Number and Type of Housing Units	Description
Belvoir Village	59 Residential	59 single-family	brick Colonial Revival, 1934-35
	2 Residential	2 single-family	brick Colonial Revival, 1950
Gerber Village	60 Residential	60 single-family	brick Colonial Revival, 1930-34
	4 Residential	4 single-family	brick Colonial Revival, 1933
	6 Residential	12 duplexes	brick Colonial Revival, 1939

TABLE 4-17
Historic Housing Involved in RCI

Village	Number and Type of Buildings	Number and Type of Housing Units	Description
	6 Garages	-- --	brick Colonial Revival,1940
Jadwin Village/Jadwin Loop	5 Residential	5 single-family	frame Craftsman "T" shape, 1920-21
	9 Residential	9 single-family	frame Craftsman " L" shape, 1920-21
	5 Residential	25 townhomes	brick Colonial Revival, 5-unit, 1940
	5 Garages	-- --	brick, 1939
Jadwin Village/21st Street	6 Residential	6 single-family	frame Craftsman "T" shape, 1920-21
Park Village	9 Residential	9 single-family	frame Craftsman "T" shape, 1920-21
	5 Residential	5 single-family	frame Craftsman " L" shape, 1920-21
Rossell Village	30 Residential	60 duplexes	brick Colonial Revival, 1947-48
	211 Buildings	**256 Housing Units**	

In addition, there are 4 historic transformers located in Gerber Village that are not proposed to be transferred and a tennis court in Belvoir Village located on the land that will be leased. The historic administration building and Thermo-Con House in Gerber Village are not included in the lease parcel or transfer of buildings.

Historic District Housing

Belvoir Village and Gerber Village were constructed as part of the extensive rebuilding and beautification of Fort Humphreys (renamed Fort Belvoir in 1935) that occurred in the inter-war period of the 1930s and 1940s. As components of the formal plan for the residential and administrative core of the post, these villages are an important part of the Fort Belvoir Historic District and are significant under NHPA Criteria A and C for their Colonial Revival architecture and community planning. Characteristic features of the buildings include symmetrical facades, brick exteriors, and limestone detailing. The plan of these officers' neighborhoods, along curvilinear streets with central greenswards and grand trees, resembles 1930s garden-style suburban design. The park-like setting of Belvoir Village takes advantage of the natural topography and vistas of the Potomac. The Commanding Officer's Quarters (Building 1) in Belvoir Village is situated on a promontory overlooking the Potomac River (ICRMP and Goodwin, n.d.). The Officers Club and Visiting Officers Quarters at Belvoir Village and the NCO Club and Thermo-Con House at Gerber Village are not included among the buildings proposed for transfer to FBRC.

The "temporary" Craftsman-style, wood-frame houses in Park Village and Jadwin Village (sometimes referred to as "T-400s" housing) were designed in the 1920s by Captain W.H. Peaslee and Captain A.A. Hockman of the Quartermaster Corps, around the time that the Engineer School was moved from the Washington Barracks and before Camp A. A. Humphreys became a permanent post as Fort Humphreys. There are currently a total of 14 L-shaped and 14 T-shaped Craftsman houses remaining on Fort Belvoir, in Park and Jadwin Villages. Others in Park and Jadwin Village were previously demolished.

The six T-shaped houses in Jadwin Village along 21st Street were determined to be contributing elements to the Fort Belvoir Historic District in 1984. In February 2003, the Virginia SHPO concurred with Section 110 documentation (John Milner & Associates, 2002) that recommended the remaining 1920s Craftsman-style houses as contributing elements to an expanded Historic District (DPW&L-ENRD personal communication, May 2003).

The five brick buildings in Jadwin Village (25 townhouse units) were constructed toward the end of the 1930s expansion campaign at Fort Belvoir. The Rossell Loop buildings (60 duplex units) were constructed after WWII, originally as JNCO apartments, and were later converted to two-story duplexes. A 2000 Historic Building Survey recommended these 35 brick buildings in Rossell and Jadwin Villages as contributing elements to an expanded Historic District and the Virginia SHPO has concurred (DPW&L-ENRD personal communication, May 2003).

Capehart-Wherry Housing

The majority of existing Army family housing units nationwide were built during the Capehart (1955-1962) and Wherry (1949-1955) eras. These post-WWII programs (like RCI) engaged the private sector in constructing military housing neighborhoods, similar to what was being built in civilian neighborhoods at the time, to address a military family housing shortage that was affecting the retention of personnel (AEC, 2002).

On May 31, 2002, the Advisory Council approved the Army's request for a "Program Comment on Capehart and Wherry Era (1949-1962) Army Family Housing, Associated Structures, and Landscape Features." The Army sought this programmatic approach to Section 106 compliance because of the large number of Capehart-Wherry buildings that have or will soon reach the 50-year eligibility threshold for the NRHP and their potential to be affected by RCI. The Program Comment has provided Army-wide Section 106 review, instead of individual project-specific reviews, for all undertakings affecting Capehart and Wherry buildings and landscape features, including maintenance and repair, rehabilitation, renovation, demolition and transfer, sale or lease out of Federal control.

As a result, Section 106 consultation for these undertakings at individual installations is not required. The Army Environmental Center (AEC) is carrying out the nationwide treatment measures required by the Capehart-Wherry Program, including an expanded historic context study, neighborhood design guidelines for Capehart-Wherry housing that will be renovated or rehabilitated, identification of potential properties of particular importance, video documentation and preservation efforts to maintain selected properties as military family housing.

On Fort Belvoir, Lewis Heights Village is a Wherry neighborhood with 428 units in brick apartment buildings. Colyer Village contains a mixture of 68 Capehart and Wherry-era rowhouses and 24 Wherry-era apartment-style units. Fairfax, George Washington, Dogue Creek, and River Villages are Capehart neighborhoods that contain a total of 942 brick duplexes and townhouses.

Other Buildings

Table 4-18 shows the status of the existing buildings that would be demolished to make space for the new homes and Recreation Center at the proposed New South Post Village.

Three of these four buildings are more than 50 years old and a 1992 architectural survey recommended that they are not eligible for listing on the NRHP. However, no formal determination of eligibility was ever submitted to the Virginia SHPO for these resources. Another survey is required to determine their NRHP-eligibility (DPW&L-ENRD, personal communication, May 21, 2003).

TABLE 4-18
Buildings on Proposed New South Post Village Parcel

Building Number	Description	Year Built	Year Surveyed	Status	Comments
1001	Concrete/masonry, Army Community Service Center	1945	1992	Undetermined	Survey required
1021	Brick storehouse	1940	1992	Undetermined	Survey required
1022	Brick transformer building, storage	1935	1992	Undetermined	Survey required
1029	Telecomm building (and satellites)	1983	-	-	Less than 50 years old; no survey required

In addition, five administrative and maintenance buildings will be leased to FBRC for use as offices for property management and construction personnel, maintenance and temporary construction support facilities (see section 2.2.1.3). Fort Belvoir will grant a separate (revocable) lease to FBRC for the use of these buildings, instead of transferring them or including them in the 50-year ground lease.

These buildings are: 766 (warehouse built 1994), 1108 (warehouse built 1955), 1436 (applied instruction building built 1970), 1126 (warehouse built 1955) and 1144 (warehouse built 1917). Four of these buildings are less than 50 years old. Building 1144 is considered to be a contributing resource to the Fort Belvoir Historic District. No physical alterations are planned for this NRHP-eligible building.

4.8.1.4 Archeological Resources

The APE for archeological resources for the RCI project is defined as all of the parcels proposed for development (housing villages and recreation center) and the additional sites proposed for temporary use as construction staging areas.

A review of known archeological and archeologically sensitive areas by Fort Belvoir has determined that archeological resources are present in and near the proposed housing areas and temporary construction support areas. Due to the sensitive nature of the information, details about the specific locations of these sites are not provided in this document. Fort Belvoir will provide site-specific information to appropriate individuals or agencies on a need-to-know basis. Table 4-19 lists archeological sites that are within or adjacent to the RCI parcels.

Nineteen archeological sites are present on the subject properties and another three sites are about 50 feet or less away from the approximate parcel boundaries (Table 4-19). Phase I archeological surveys have suggested that 11 of these 19 sites are potentially eligible for listing on the NRHP. A Phase II study evaluated two of the 19 sites and recommended them to be

eligible for listing. Phase I surveys suggested that the remaining seven sites would not be eligible for listing and recommended no further study of those sites.

TABLE 4-19
Archeological Sites In or Near the RCI Footprint

Location Relative to RCI	Site ID	Chronology	Type/Function	NRHP Status
Belvoir Village	44FX1675	Prehistoric	Potential campsite	Not Eligible
Belvoir Village	44FX1676	Prehistoric	Unidentified	Not Eligible
Belvoir Village	44FX1927	Prehistoric	Unidentified	Potentially Eligible
Belvoir Village	44FX1930	Prehistoric	Unidentified	Potentially Eligible
Colyer Village	44FX1921	Prehistoric	Unidentified	Potentially Eligible
Dogue Creek Village	44FX1340	Prehistoric/ Historic	Unidentified/ 18th century domestic	Eligible
Dogue Creek Village	44FX1925	Prehistoric	potential campsite	Potentially Eligible
Dogue Creek Village	44FX10	Prehistoric	Unidentified	Potentially Eligible
Dogue Creek Village	44FX1926	Prehistoric	Potential campsite	Not Eligible
Fairfax Village	44FX1928	Prehistoric	Potential campsite	Potentially Eligible
Fairfax Village	44FX1929	Prehistoric	Unidentified	Potentially Eligible
George Washington Village	44FX9	Prehistoric	Unidentified	Potentially Eligible
Jadwin Village	44FX1922	Prehistoric	Potential campsite	Not Eligible
Jadwin Village	44FX1923	Prehistoric	Potential campsite	Not Eligible
Woodlawn Village	44FX1498	Prehistoric	Potential campsite	Potentially Eligible
Woodlawn Village	44FX1946	Prehistoric/ Historic	Unidentified	Potentially Eligible
Woodlawn Village	44FX1947	Historic	Domestic	Potentially Eligible
Construction staging	44FX624	Historic	Early 20th century	Not Eligible
Construction staging	44FX1503	Prehistoric		Not Eligible
Fairfax Village *(adjacent)*	44FX4	Historic	18th century plantation Complex	NRHP-listed[1]
Fairfax Village *(within 50 ft)*	44FX1505	Historic	20th century Military training trenches	Eligible[2]
Dogue Creek *(within 50 ft)*	44FX1344	Prehistoric		Not Eligible[2]

Notes:

1. Site 44FX4 abuts Fairfax Village and near Belvoir Village. It will be excluded from the RCI ground lease by the metes and bounds survey.

2. Sites 44FX1505 and 44FX1344 appear to be within 50 feet of an approximate parcel boundary and will also be excluded by the metes and bounds survey.

The parcel proposed for new construction of New South Post Village housing and Recreation Center has been surveyed and contains no known archeological sites.

Another three archeological sites that are located approximately less than 50 feet away from the proposed RCI parcels also are listed in Table 4-19, because RCI parcel boundaries are approximate until the metes and bounds survey is completed and because the boundaries of

the sites depicted in Fort Belvoir's GIS database must be considered inexact until site boundaries are confirmed in a field survey by global positioning system (GPS). One of these adjacent sites (44FX4), which was listed on the NRHP in 1973, abuts the Belvoir and Fairfax Villages parcels and contains the ruins of Belvoir Manor and the Fairfax family cemetery. The boundaries of site 44FX4 will be confirmed by field survey before the RCI ground lease is finalized and the metes and bounds survey will ensure that these site is completely excluded from the leased parcel. Sites 44FX1344 and 44FX1505, which appear to be about 50 feet from Dogue Creek Village and Fairfax Village, respectively, will also be excluded from those leased parcels by the metes and bounds survey.

Cemeteries

There are no cemeteries located within the parcels proposed for leasing to FBRC, but three cemeteries are adjacent or nearby. The Fairfax family burial site, which is a part of the NRHP-listed Belvoir manor archeological site (44FX4) is immediately adjacent to the Fairfax Village parcel. As discussed above, the metes and bounds survey will exclude this site from the parcel to be leased to FBRC. Private cemeteries of the Alexandria Friends Meeting–Religious Society of Friends and the former Woodlawn United Methodist Church are near the Lewis Heights parcel, roughly 400 feet to the southwest and 200 feet to the northwest, respectively.

4.8.1.5 Offsite Historic Properties

In addition to on-post resources, there are a number of important historic resources in the surrounding area, including Mount Vernon, George Washington's home and Gunston Hall, George Mason's home.

In 1971, Fairfax County established the Woodlawn Historic Overlay District, currently one of thirteen such districts in the county. The core of the Woodlawn Historic Overlay District encompasses several historic properties near Fort Belvoir:

- Woodlawn Plantation - an 18th-century mansion owned and operated by the National Trust for Historic Preservation that was the home of Eleanor Custis (granddaughter of Martha Washington) and her husband, Lawrence Lewis (George Washington's nephew)
- Pope/Leighey House - a "Usonian" house designed by Frank Lloyd Wright and moved from the path of highway project to Woodlawn Plantation in 1965
- Alexandria Friends Meeting House (also referred to as Woodlawn Friends Meeting House)
- Woodlawn Baptist Church
- Woodlawn Stables
- George Washington's Grist Mill

The Alexandria Friends Meeting House and cemetery is surrounded by the installation and the rest of these historic properties are within ¼-mile of the installation boundary. Figure 4-8 shows the location of the Woodlawn Historic Overlay District in relation to the RCI project area.

Historic Overlay Districts are established by amendment to the county's zoning ordinance and may consist of a single property or group of related properties. The county regulates new construction and changes to existing structures within Historic Overlay Districts to ensure compatibility with the historic resources on which the districts are based. This includes changes to the exterior appearance of any building, structure, or site located in the district, if it is visible from a public right-of-way or from a contributing or historic property within the district (Fairfax County, 2002; Fairfax County, 2003). Although local zoning and site plan review processes do not apply to Federal property, Fairfax County's interests in construction activities within the Woodlawn Historic Overlay District have been taken into account through the Section 106 consultation process.

Lewis Heights Village, which is adjacent to Woodlawn Plantation and is located on land that was originally part of Woodlawn Plantation, is entirely within the Woodlawn Historic Overlay District. Lewis Heights is visible from various points of view on Woodlawn Plantation, especially from the access road and second floor of the mansion. George Washington Village, which is near Woodlawn Stables, is partially included in the Historic Overlay District. River Village, which is visible from the top floor of George Washington's Grist Mill (not accessible to the public) and from Mount Vernon Memorial Highway, is partially included in the Historic Overlay District.

4.8.1.6 Section 106 Consultation

Fort Belvoir initiated Section 106 consultation for the RCI project with a letter to the Virginia SHPO dated February 6, 2003 (Appendix D). Since that time, the SHPO and staff members have met several times with Fort Belvoir and its RCI partner to discuss details of the proposed action. In a letter dated April 18, 2003, Fort Belvoir invited the Advisory Council on Historic Preservation to participate in the Section 106 consultation process. Three organizations (National Trust for Historic Preservation–Woodlawn Plantation, Alexandria Friends Meeting–Religious Society of Friends, and Fairfax County) have requested and been granted consulting party status under Section 106 regulations.

No transfer of historic buildings, leasing of land containing historic resources, construction in the vicinity of historic resources, or rehabilitation of historic buildings will proceed until the Section 106 consultation process has been completed.

A Programmatic Agreement (PA) has been drafted by the Army and is being developed in consultation with the Virginia SHPO and other consulting parties. The PA considers the proposed treatment of known and potential archeological resources, historic structures and cultural landscapes and addresses mitigation for any potential adverse impacts of the proposed RCI action to historic properties within the APE.

After it has been concluded, a PA will become a part of the RCI ground lease and its provisions will remain as a requirement on the RCI partnership, until all of the housing reverts to the Army at the end of the 50-year (or 75-year, if extended) lease period.

The Advisory Council's Program Comment has already provided an Army-wide Section 106 review for all undertakings affecting Capehart-Wherry historic resources. Therefore, no further Section 106 consultation is necessary for RCI actions affecting Fort Belvoir's Capehart and Wherry-era housing in Lewis Heights, Colyer, Fairfax, George Washington, Dogue Creek and River Villages (see section 4.8.2.1).

4.8.1.7 Public and Stakeholder Involvement

The public and stakeholder participation process required by Section 106 was initiated at the public scoping meeting for this EA in January 2003. Fort Belvoir then invited interested parties, including local government, historic property owners, historic preservation organizations, religious organizations and individuals who had expressed interest in the historic resources, to attend public meetings on March 12 and May 13, 2003. In addition, military families living in Fort Belvoir's historic housing were surveyed to help determine priorities for rehabilitating their housing and were invited to discuss their needs at meetings. Comments received from the scoping meeting, follow-up public meetings, coordination with historic housing residents, and focus meetings with consulting parties were considered in drafting the Programmatic Agreement for the RCI action. The Army will provide appropriate public notice before the PA is executed.

4.8.1.8 Native American Resources

With the exception of the archeological resources described in section 4.2.1.1, no known resources of Native American interest are located within the project area.

4.8.2 Consequences

4.8.2.1 Proposed Action

By definition, transfer of historic buildings to FBRC is considered an adverse effect under the NHPA. Other planned activities that are part of the proposed action will also result in adverse effects on historic properties, as summarized in Table 4-20 and discussed in this section.

From a NEPA perspective, adverse effects to historic properties under the NHPA are considered significant impacts if those adverse effects cannot be resolved through the Section 106 consultation process. Fort Belvoir anticipates that adverse effects of the RCI project will be resolved, by incorporating input from stakeholders and designing mitigation measures, in accordance with a PA that is being developed in consultation with the Virginia SHPO and other consulting parties. The undertaking is not expected to result in significant impacts, because adverse effects on historic properties will be addressed by implementation of the mitigation measures that are determined appropriate and agreed to by the Section 106 consulting parties. The Section 106 consultation process will be completed before any actions affecting historic properties, beginning with the transfer of the buildings to FBRC, are undertaken.

4.8.2.2 Architectural Resources

The strategy for Fort Belvoir's neighborhoods that contribute to the Fort Belvoir Historic District is to retain and rehabilitate all housing from the 1930s Colonial Revival Plan for the development of Fort Belvoir; to retain and rehabilitate examples of the 1920s temporary frame housing; and to remove the remaining 1920s housing and the 1940s housing in Rossell Village to allow redevelopment of housing villages within the limited land areas currently available. In all, 73.5 percent (155 of 211) of the historic buildings will be rehabilitated and 26.5 percent (56 of 211) of the historic buildings, those which have been determined to be inappropriate for rehabilitation based on their condition and siting, will be demolished.

TABLE 4-20
Summary of Potential Effects on Historic Properties

Village	Resource Description	NRHP Status	Potential Project Impact	Project Action for Resource	Anticipated NHPA Effect
Belvoir Village	59 Brick single-family houses, Colonial Revival, 1934-35	Eligible	Alteration	Retain and rehabilitate in accordance with PA	Adverse Effect *
	2 brick single-family houses, 1950	Eligible	Alteration	Retain and rehabilitate in accordance with PA	Adverse Effect *
	site 44FX1675	Not Eligible	Road maintenance and utilities. Site is under existing road.	Proceed in accordance with PA	No Adverse Effect
	site 44FX1676	Not Eligible	Road maintenance and utilities. Site is under existing road and near front of one house to be rehabilitated.	Proceed in accordance with PA	No Adverse Effect
	site 44FX1927	Potentially Eligible	Resource eastern edge abuts parcel boundary in area not planned for disturbance	Will avoid	No Effect
	site 44FX1930	Potentially Eligible	Resource western edge abuts parcel boundary in area not planned for disturbance	Will avoid	No Effect
Colyer Village	92 Capehart housing units		Demolish and replace	Mitigation is addressed in Program Comment	No Adverse Effect
	site 44FX1921	Potentially Eligible	Construction of six new homes	GPS boundaries and Phase II evaluation. Mitigate if determined eligible.	Adverse Effect unless determined not eligible
Dogue Creek Village	270 Rebuilt Capehart housing units		Maintain during IDP; demolish and replace in out years	Mitigation is addressed in Program Comment	No Adverse Effect
	site 44FX1340	Eligible	No ground disturbance planned	Will avoid	No Effect
	site 44FX1925	Potentially Eligible	No ground disturbance planned	Will avoid	No Effect

TABLE 4-20
Summary of Potential Effects on Historic Properties

Village	Resource Description	NRHP Status	Potential Project Impact	Project Action for Resource	Anticipated NHPA Effect
Dogue Creek Village (cont.)	site 44FX10	Potentially Eligible	Site is under existing park; possible surface improvements to park under license from installation.	Metes and bounds survey will exclude site from lease. Phase II evaluation if ground disturbance is planned. Will avoid if eligible.	No Adverse Effect
	site 44FX1926	Not Eligible	None	Will avoid	No Effect
Dogue Creek *(within 50-ft)*	44FX1344	Not Eligible	Within 50 feet of parcel boundary. GPS boundaries.	Will exclude from ground lease and avoid	No Effect
Gerber Village	60 brick single-family houses, Colonial Revival, 1930-34	Eligible	Alteration	Retain and rehabilitate in accordance with PA	Adverse Effect *
	4 brick single-family houses, Colonial Revival, 1934	Eligible	Alteration	Retain and rehabilitate in accordance with PA	Adverse Effect *
	6 brick duplex buildings, Colonial Revival, 1939	Eligible	Alteration	Retain and rehabilitate in accordance with PA	Adverse Effect *
	6 brick garages,1940	Eligible	Alteration	Retain and rehabilitate in accordance with PA	Adverse Effect *
	(no archeological sites)				
Fairfax Village	148 Capehart housing units		Demolish and replace	Mitigation is addressed in Program Comment	No Adverse Effect
	site 44FX1928	Potentially Eligible	Construction - site's southern edge overlaps part of two new home sites. If not needed for lot setbacks, the wooded area between Fairfax and Belvoir Villages, including most of this site, is expected to be removed from the ground lease by the metes and bounds survey.	GPS boundaries and Phase II evaluation. Avoid or mitigate if determined eligible.	Adverse Effect unless avoided or determined not eligible

TABLE 4-20
Summary of Potential Effects on Historic Properties

Village	Resource Description	NRHP Status	Potential Project Impact	Project Action for Resource	Anticipated NHPA Effect
Fairfax Village (cont.)	site 44FX1929	Potentially Eligible	Construction - site's northwestern edge abuts one new home site and eastern edge abuts 2 existing houses to be rehabilitated (Belvoir Village). The area including most of this site is expected to be removed from parcel by metes and bounds (see above).	GPS boundaries and Phase II evaluation. Avoid or mitigate if determined eligible.	Adverse Effect unless avoided or determined not eligible
Fairfax Village *(within 50-ft)*	site 44FX1505	Eligible	Site's western edge about 50-100 feet from proposed new home site	Will exclude from ground lease and avoid during construction	No Effect
Fairfax Village *(within 50-ft)*	site 44FX4	NRHP-listed	Rehabilitation of existing house (Belvoir Village) about 50 feet away. Two new houses proposed within 50-100 feet of the site.	Will GPS boundaries and exclude from ground lease. Final site design on adjacent parcel will avoid impacts to this site.	No Effect
George Washington Village	244 Capehart housing units		Demolish and replace	Mitigation is addressed in Program Comment	No Adverse Effect
	site 44FX9	Potentially Eligible	Construction. Under existing Mount Vernon Road and proposed new intersection with Statesman Road.	GPS boundaries and Phase II evaluation. Mitigate if determined eligible.	Adverse Effect unless determined not eligible
Jadwin Village (Jadwin Loop)	5 Single-family, frame Craftsman T-shape, 1920-21	Eligible	Demolish and replace	Mitigation in accordance with PA	Adverse Effect
	9 Single-family, frame Craftsman L-shape, 1920-21	Eligible	Demolish and replace	Mitigation in accordance with PA	Adverse Effect
	5 5-unit brick (25 townhouses), 1940	Eligible	Alteration	Retain and rehabilitate in accordance with PA	Adverse Effect *

TABLE 4-20
Summary of Potential Effects on Historic Properties

Village	Resource Description	NRHP Status	Potential Project Impact	Project Action for Resource	Anticipated NHPA Effect
	5 Brick garages, 1939	Eligible	Alteration	Retain and rehabilitate in accordance with PA	Adverse Effect *
Jadwin Village (21st Street)	6 Single-family, frame Craftsman T-shape, 1921	Eligible	Alteration	Retain and rehabilitate in accordance with PA	Adverse Effect *
	site 44FX1922	Not Eligible	Construction of one new townhouse building and realignment of Jadwin Loop.	Proceed in accordance with PA	No Adverse Effect
	site 44FX1923	Not Eligible	Construction or road maintenance and utilities. Site's western edge abuts existing townhouse building and is under existing alley behind it.	Proceed in accordance with PA	No Adverse Effect
Park Village	9 Single-family, frame Craftsman T-shape, 1920-21	Eligible	Demolish and replace	Mitigation in accordance with PA	Adverse Effect
	3 Single-family, frame Craftsman L-shape, 1920	Eligible	Demolish and replace	Mitigation in accordance with PA	Adverse Effect
	2 Single-family, frame Craftsman L-shape, 1920	Eligible	Alteration	Retain and rehabilitate in accordance with PA	Adverse Effect*
	(no archeological sites)				
Rossell Village	30 Brick buildings (60 duplex units), 1947-48	Eligible	Demolish and replace	Mitigation in accordance with PA	Adverse Effect
	(no archeological sites)				
Woodlawn Village	(no historic housing)				
	site 44FX1498	Potentially Eligible	Construction. Site is inside the existing ring road on 8 replacement home sites.	GPS boundaries and Phase II evaluation. Mitigate if determined eligible.	Adverse Effect unless determined not eligible

TABLE 4-20
Summary of Potential Effects on Historic Properties

Village	Resource Description	NRHP Status	Potential Project Impact	Project Action for Resource	Anticipated NHPA Effect
Woodlawn Village (cont.)	site 44FX1946	Potentially Eligible	Road maintenance and utilities. Site's eastern edge is under existing road.	GPS boundaries and Phase II evaluation. Avoid or mitigate.	Adverse Effect unless avoided or determined not eligible
	site 44FX1947	Potentially Eligible	Road maintenance and utilities. Site's southwestern edge is under existing roads (Pole Rd and Plantation Dr). Metes and bounds survey is expected to remove most of this site.	GPS boundaries and Phase II if necessary. Avoid if practicable.	Adverse Effect unless avoided or determined not eligible
New South Post Village	3 buildings more than 50 years in age	Undetermined	Demolish	Architectural Survey. Mitigate if determined eligible.	No Adverse Effect
	(no archeological sites)				
Construction Support	site 44FX624	Not Eligible	Concrete plant and stone crusher	Proceed in accordance with PA	No Adverse Effect
	site 44FX1503	Not Eligible	Concrete plant and stone crusher	Proceed in accordance with PA	No Adverse Effect
Property Maintenance	1 warehouse built in 1917	Eligible	Storage of appliances and nonperishable supplies	No physical alteration. To be leased, not transferred.	No Adverse Effect

* Rehabilitation will be conducted in accordance with the terms of the Programmatic Agreement being developed with Virginia SHPO and the Secretary of the Interior's Treatment Standards. Mitigation measures for adverse effects will also be performed in accordance with the Programmatic Agreement.

These actions will result in multiple adverse effects to historic properties that will require mitigation.

Alterations and Infill Housing

Rehabilitation and additions are proposed for Fort Belvoir's historic houses to provide modern, functional, and convenient homes. To avoid or minimize adverse effects, interior and exterior rehabilitation will be conducted in accordance with measures agreed to by the Section 106 consulting parties and the Secretary of the Interior's Treatment Standards.

Infill housing will be designed to be compatible in scale, style and materials, but will not be a copy of the historic housing. Details will be distinct and elevations will vary somewhat in form.

Proposed details about alterations to historic structures provided in this EA are based on preliminary design and are subject to the ongoing Section 106 consultation process. The final scope of work also is dependent on negotiation of the final CDMP between the Army and the development entity, as well as the terms of the PA being developed by the Army with the Virginia SHPO and other consulting parties.

In Belvoir Village, interior rehabilitation may include actions, as needed, such as enlarging and modernizing kitchens, baths and closets; refinishing wood surfaces and repairing plaster walls and ceilings; repairs to alleviate basement flooding problems; and repairing and upgrading electrical, plumbing, telecommunications and mechanical systems. Structural alterations being considered may include expanding the living space into the existing garages and adding detached two-car garages at the side or rear. Exterior rehabilitation work may include actions such as maintenance of painted surfaces, roofs, masonry, and windows, with possible in-kind replacement of some deteriorated windows, and improving existing lawns and landscaping in harmony with the historic landscape of Belvoir Village.

Up to five new infill houses will be constructed on available home sites along Belvoir Road at the entry to the village, maintaining the original spacing, siting, and character of Belvoir Village. The infill houses will be compatible with the historic houses in the Village, but readily identifiable as different. In Belvoir Village, infill houses will still be in the Colonial Revival style, but will have hip roofs instead of gabled, front porches will be distinct from the historic houses, and there will be recessed attached garages (Krause, personal communication, June 2003).

Additions that are proposed to enlarge the Gerber Village houses would be constructed to the rear of the houses, preserving the existing appearance of the house fronts. To provide covered parking and storage space, new detached, two-car garages are proposed (across the alley) for units in Gerber Village and existing garages would be expanded to two-car garages. In the duplex houses, interiors may be remodeled to improve circulation problems and enlarge bedrooms. Basement work will be done to eliminate flooding, mildew and insect problems windows and doors will be repaired. In all houses, interior rehabilitation may include actions such as refinishing wood surfaces and trim; replacing heating and air conditioning systems (HVAC); upgrading electrical, lighting, telephone, and cable TV systems and adding Internet service.

Other exterior rehabilitation work may include maintenance on painted surfaces, roofs, masonry, and windows, with possible in-kind replacement of some deteriorated windows. Additions will relate to the existing neighborhood by adding elements of similar scale, mass, proportion, and materials. Landscaping will be maintained and upgraded on an ongoing basis consistent with the historic landscape of the Village.

Up to five new infill housing units will be constructed on available home sites, maintaining the original spacing, siting, and character of Gerber Village. New infill housing in Gerber Village will be Cape Cod in style, but with flanking frame wings and a symmetrical entrance, unlike the offset entry and side porch of the original houses.

In Jadwin Village, interior rehabilitation in the brick townhouses may include actions such as upgrading plumbing; renovating kitchens; refinishing wood, trim, windows and doors; upgrading electrical and telecommunications wiring; and replacing HVAC systems. Exterior rehabilitation is proposed to include adding new or expanding existing detached multi-car garages, to provide more secure storage space and two garage spaces per unit, and improving common play areas for children.

Most of the 1920s frame Craftsman-style houses in Jadwin and Park Villages are proposed for demolition due to the siting, layout, and condition of the buildings (see the following subsection for a discussion of demolition). Examples of both the T-shaped and L-shaped houses will be preserved and rehabilitated.

Interior rehabilitation of the frame Craftsman-style houses on 21st Street may include actions such as renovating existing bathrooms and adding a bathroom; upgrading kitchens; updating electrical and other systems; and refinishing wood trim and floors. Exterior rehabilitation actions may include providing garages and secure storage; replacing gutters and downspouts; and improving general maintenance. The aluminum siding on these houses will be replaced, to be more in keeping with the original appearance, and some other period details will be restored. Enlarging these houses has the potential for adverse effects on their historic architectural integrity.

The frame Craftsman-style T-shaped houses on the north side of Jadwin Loop will be demolished and replaced with six new brick buildings, consistent with the 1930s development plan for Jadwin Village. The new brick townhouses will be comparable in scale to the historic brick 5-unit townhouse buildings, but with different roof configuration and fenestration.

Two of the L-shaped, 1920s Craftsman-style houses in Park Village will be retained and rehabilitated in the same manner as the T-shaped houses on 21st Street, as examples of a previously-abundant housing type on Fort Belvoir. The other frame T- and L-shaped houses in Park Village will be demolished and replaced. New replacement housing will be constructed in a Craftsman style, compatible with the remaining one story T-400 houses, so as to not overwhelm them in scale. Front porches and carpenter details will recall the early 1920's character of the remaining historic T-400 houses. Incorporating a small adjacent and currently vacant lot into the redeveloped village will allow the street to be expanded into a loop with a central green, similar to other villages in Fort Belvoir.

Demolition

Demolition of the Craftsman houses in Jadwin and Park Villages and the brick buildings in Rossell Village will result in adverse effects on historic properties. This action is proposed for the following reasons:

Jadwin Loop: Unit analysis requires significant rehabilitation and small additions, as well as the construction of freestanding garages on the T-400 frame houses, to make them appropriate as family housing that would be comparable to the new homes. Electrical systems do not meet current standards; insulation in walls and crawlspaces is inadequate; and bathrooms, closet, and storage space is inadequate. In addition, the topography of most of the neighborhood, with houses perched on steep hillsides, has caused minor structural problems and would greatly increase the cost of rehabilitation. The topography, condition and size of the houses would also make relocation very difficult. For this reason, only the six "T" shape frame houses along 21st Street are to be rehabilitated for use as family housing.

Snow Loop/Park Village: There are three remainingT-400 houses in Snow Loop, all in very poor condition. This area is no longer appropriate for family housing, and given the condition of the remaining units, demolition is the only reasonable option.

In Park Village, the houses are sited such that it is difficult to achieve the required density for the neighborhood with the existing orientation and spacing of the houses. This, in combination with the extra cost, makes it infeasible to retain and rehabilitate additional units. However, two of the "L" shaped units will be retained, so that examples of each World War I era housing type remain in use as family housing on Fort Belvoir.

Rossell Loop: The existing duplex housing units at Rossell Loop are notably inadequate, relative to the new housing being planned for Ft. Belvoir, in terms of size, type and configuration of rooms. Kitchens are too small for more than modest improvement; electrical systems do not meet current standards; closet and storage space is inadequate; and there is no room to add garages or carports. The layout makes modest expansion infeasible, so that wholesale interior renovation would be required. The cost of this level of renovation and expansion makes saving these buildings cost prohibitive. In addition, the new housing layout allows for more housing units, with the ability to meet the "smart growth" goals of the RCI plan (Krause, personal communication, June 2003).

Mitigation strategies being considered to resolve the adverse effect of demolishing these historic buildings include:

- Retaining and rehabilitating two of the L-shaped houses in Park Village to preserve an example of this building type
- Performing Historic American Buildings Survey (HABS) documentation on one of each type of historic building, including its setting and surrounding landscape features, prior to removal. This documentation will provide an historic context and large format photographs, along with copies of existing plans, maps and other records for transmission to the Library of Congress
- Preparing an Internet-ready, multi-media presentation on the history of 20th century Army family housing at Fort Belvoir, in coordination with the Fort Belvoir Cultural

Resources Manager, that will be exhibited at the new Welcome Center and made available to the Section 106 consulting parties and the public.

In addition, FBRC will explore the feasibility of donating or selling structures to non-government parties, historic architectural salvage, and relocation and adaptive reuse of some structures on Fort Belvoir.

Capehart-Wherry Housing

In planning the RCI actions that will affect Capehart-Wherry housing, associated structures, and landscape features, the Fort Belvoir RCI partnership has reviewed and considered the Neighborhood Design Guidelines for Army Wherry and Capehart Era Family Housing, currently in Preliminary Draft form. The Guidelines address many areas of housing design in the Capehart Wherry construction eras, from site planning methods to buildings, patios, roofs, windows and ancillary structures such as carports and storage sheds.

The Army has determined that the existing Capehart-Wherry housing units at Fort Belvoir should be demolished because they do not meet the Army's housing needs and requirements at Fort Belvoir, for the reasons detailed below. This will result in an adverse (but not significant) effect on historic resources. Although Fort Belvoir is not one of the installations selected for the AEC's nationwide Capehart-Wherry recordation program under the Advisory Council's Program Comment, that nationwide program will provide mitigation for the demolition of Capehart-Wherry housing on Fort Belvoir.

The design principles originally applied to the neighborhood organization of housing areas from the Capehart-Wherry Era are inappropriate for the redevelopment of the housing areas at Fort Belvoir and the reintegration of the existing housing communities with each other and the Main Post at-large. The Fort Belvoir RCI design team found the Design Guidelines to be directing development toward continuing patterns based upon a 1950's paradigm of design that is associated with the boom of tract housing, automobile-oriented neighborhoods, and the economically-built and easily reproduced styles of that time.

The guiding principles of Fort Belvoir's RCI require the design team to build neighborhoods that incorporate the "smart growth" design principles of pedestrian-oriented design elements. These "smart growth" principles are synonymous with sustainable design practices and include small front yard setbacks, short blocks within an efficient street framework, interconnected sidewalks that are unencumbered by driveways, and continuous circulation patterns without dead-ends.

The Fort Belvoir RCI design concept for these neighborhoods does contain a number of elements that are consistent with the Design Guidelines in spirit, if not in actuality: the communities are planned; there are uniform building setbacks; and open spaces and common areas are provided. However, these elements are provided and integrated into the redeveloped communities in ways other than the Guidelines suggest (Hesler, personal communication, June 2003).

Other Buildings

None of the structures remaining on the parcel where the proposed New South Post Village would be built are currently considered by the Army to be eligible for listing on the NRHP. However, documentation for the three buildings (1001, 1021 and 1022) that are more than

50 years old was never formally submitted to the Virginia SHPO. Before they are demolished, another survey will be conducted and submitted to the SHPO to determine their NRHP-eligibility. If necessary, the Army will consult further with the SHPO to resolve the adverse effect of their demolition.

No physical alterations are planned for Building 1144 (NRHP-eligible warehouse built 1917), which will be leased for continued use as a storage building.

The foundation of the former Commanding Officer's house (demolished in 1966) is located behind the brick townhouses at the eastern end of Jadwin Loop. This structural remnant has not previously been evaluated or considered as an historic property (DPW&L-ENRD, personal communication, August 2002 and May 2003). The exact location has not been documented, but the approximate location is not within the area of planned disturbance for Jadwin Village. The metes and bounds survey is expected to exclude a portion of the Jadwin Village parcel from the ground lease (undisturbed land outside the existing park area) and it appears that this area would include the old foundation.

4.8.2.3 Archeological Resources

Table 4-19 (above) lists archeological sites that are within or adjacent to the subject parcels and identifies the potential effect of project actions on those sites.

In accordance with the terms of the PA currently being developed, prior to any new construction on previously undeveloped land, Fort Belvoir will determine the need for an survey. If a survey is recommended, the Fort Belvoir Cultural Resources Manager will undertake a survey of the APE sufficient to determine the NRHP-eligibility of historic properties. If NRHP-eligible archeological sites will be affected by the undertaking, the Army will consult with the Virginia SHPO to determine how to avoid or resolve an adverse effect on the affected sites.

Nine sites will not be affected by the proposed action. Four of these sites (44FX4–the Belvoir Manor ruins, 44FX10 in Dogue Creek Village, and 44FX1344 and 44FX1505, which appear to be about 50 feet from the approximate boundaries of Dogue Creek Village and Fairfax Village, respectively) will be excluded from the ground lease by the metes and bounds survey. The other five (44FX1927, 44FX1930, 44FX1340, 44FX1925, 44FX1926) are not in the area of proposed ground disturbance and will be avoided.

Seven sites that are potentially eligible for listing on the NRHP are in the proposed area of ground disturbance (44FX1921, 44FX1928, 44FX1929, 44FX9, 44FX1498, 44FX1946 and 44FX1947). At the conceptual design stage, it appears that three of these sites cannot be easily avoided (44FX1921 in Colyer Village, 44FX9 in George Washington Village and 44FX1498 in Woodlawn Village). Efforts will be made in final site planning to avoid these sites; however, if they have been determined to be NRHP-eligible and it is not practicable to avoid them, the affected sites would be mitigated in consultation with the Virginia SHPO. The other four sites (44FX1928 and 44FX1929, located mostly on wooded land between Fairfax and Belvoir Villages, plus 44FX1946 and 44FX1947in Woodlawn Village) could be affected by road paving or housing construction, but it may be feasible to avoid them in the final site planning. Most of site 44FX1947 in Woodlawn Village is expected to be excluded from the ground lease by the metes and bounds survey, but a portion of it appears to lie under existing roads.

Six sites that have been recommended by Phase I surveys as not eligible for listing on the NRHP with no further need for evaluation (44FX1675, 44FX1676, 44FX1922, 44FX1923, 44FX624, 44FX1503) could be disturbed by paving roads, installing utility lines, construction of nearby housing, or operations on the temporary construction staging sites (if site grading or other ground disturbance is required to set up the concrete plant or stone crusher).

Before the ground lease is finalized, the boundaries of site 44FX4 will be reevaluated and verified by a field survey to ensure that the site will be excluded from the ground lease. After the boundaries of the site have been confirmed, the full potential impact of construction in the adjacent area of Fairfax Village will be reassessed before site design is finalized. Direct and indirect impacts of new construction to this significant NRHP-listed site will be avoided in final site planning.

Because all of the proposed construction areas have been surveyed or previously assessed as disturbed, it is unlikely that any unknown archeological sites would be discovered during new construction on the New South Post Village and Recreation Center parcels, demolition and redevelopment of existing housing, or installation of new stormwater management facilities or other utilities within existing villages.

However, if an unexpected discovery of archeological materials does occur, construction activities at that work site will immediately stop and the Fort Belvoir Cultural Resources Manager will be notified. FBRC will make every reasonable effort to ensure that no unauthorized personnel have access to the site and that no further damage is done to the discovery, until Fort Belvoir has complied with 36 CFR 800.13(b) and any other legal requirements.

Fort Belvoir will ensure that archaeological artifacts recovered from archaeological investigations or unexpected discoveries will be stored in a curatorial repository that meets federal standards stipulated in 36 CFR 79, "The Curation of Federally-Owned and Administered Archaeological Collections."

Cemeteries

No impacts to cemeteries are anticipated. As discussed above, the metes and bounds survey will exclude the Fairfax family burial site, which is a part of the NRHP-listed Belvoir manor archeological site (44FX4), from the parcel to be leased. During and after the redevelopment of Fairfax Village, public access to this cemetery and site will be maintained. The same number of parking spaces provided by the existing visitors parking lot will be replaced alongside the realigned road near the trail head (see Figure 2-3).

The proposed action will not affect the private cemeteries near the Lewis Heights parcel or change their accessibility by members of the Alexandria Friends Meeting–Religious Society of Friends and the United Methodist Church.

4.8.2.4 Viewshed Issues

Fort Belvoir Historic District

Adverse impacts to the Fort Belvoir Historic District viewshed will occur when existing historic houses are removed and others are enlarged or garages are added. The effects of altering the exteriors will be minimized by adding elements of similar scale, mass, proportion and materials, by minimizing alterations at the front of buildings, and by

maintaining landscape consistent with historic landscapes. Visual effects of removing historic buildings will be reduced somewhat by replacing them with compatible new homes, but the historic viewshed will be altered.

In addition, street furniture, street lighting and neighborhood external lighting plan have the potential to adversely affect the Historic District. Final design plans will be developed in consultation with the Fort Belvoir Cultural Resources Manager and the Virginia SHPO, as appropriate, to avoid or resolve any adverse effects.

Cultural Landscape

The historic green in the center of Belvoir Village will be maintained as-is and the tennis court, which is a contributing element to the Historic District, will be maintained. The two greens around which most of the Gerber Village houses are arranged will be retained in their existing configuration, but new garages will infringe on them by about 25 feet all around the perimeter. Building additions and garages will affect the view of the greens from the street.

The green in the center of Jadwin Village will be retained in its current location, but will be reduced in size by the rebuilding of Jadwin Loop about 100 feet inside its current northern edge. This will provide more space on the north side of Jadwin Loop so that the new homes can be built further away from the ravine than the existing houses are.

The 2001 ICRMP recommended the preparation of a Landscape Preservation Plan for the Fort Belvoir Historic District that would "document the historical evolution of the landscape design of the Historic District, identify the character-defining features associated with the designed and natural landscape and recommend measures to maintain and safeguard historic landscape features." Fort Belvoir intends to complete a historic landscape survey in the near future, to identify and assess the significance of cultural landscape features in the Historic District.

Offsite Viewshed

The redevelopment of Lewis Heights will affect views from within the Woodlawn Historic Overlay District. Potentially adverse effects have been mitigated by context-sensitive design and maintaining vegetative screening to reduce visibility historic properties within the Overlay District.

The preliminary design for Lewis Heights would remove existing houses that are currently most prominent in the view from Woodlawn Plantation and increase the green space from that viewpoint, resulting in a beneficial effect on the viewshed. The demolition of River Village will change the view from a public roadway within the Overlay District, but should have a neutral effect by removing visible buildings and maintaining existing trees. The redevelopment of George Washington Village is not expected to affect offsite viewshed.

As consulting parties in the Section 106 process, Woodlawn Plantation (the National Trust for Historic Preservation), Alexandria Friends Meeting-Religious Society of Friends and Fairfax County will be afforded an opportunity to comment on the architectural design and layout of those neighborhoods that are visible from historic properties.

4.8.2.5 No Action Alternative

Under the no action alternative to the RCI project, the Army would continue to perform ongoing maintenance of all historic housing units and could perform rehabilitation or renovation of some units. Future actions to replace buildings in Rossell, Jadwin, or Park Villages, which were under discussion before the RCI project, are possible but no definite plans have been made. Unless Fort Belvoir consults with the SHPO to arrive at a PA that would address effects of maintenance and other routine management activities, all of these actions would require individual Section 106 consultation. Fort Belvoir could proceed with plans to upgrade living conditions in Lewis Heights and the other Capehart-Wherry neighborhoods, as MCA funding becomes available, without the need for Section 106 consultation.

Existing infringement by Lewis Heights upon Woodlawn Plantation's viewshed would continue unchanged, resulting in a continued adverse effect. At present, the Lewis Heights buildings and playground are visible from various points of view including the lawn, garden and access road on the plantation and from the second story of the mansion house. Although the Army could address these effects by redeveloping Lewis Heights in the future without RCI, funding to do so is not likely to be available in the foreseeable future. The Capehart units in River Village would continue to be visible from Mount Vernon Memorial Highway in the Woodlawn Historic Overlay District.

4.9 Socioeconomic Resources

4.9.1 Affected Environment

This section describes the contribution of Fort Belvoir to the economy and the sociological environment in the region. The socioeconomic indicators used for this study include regional economic activity, population, housing, and schools. These indicators characterize the region of influence (ROI). An ROI is a geographic area selected as the basis on which demographic and economic impacts of project alternatives are analyzed. In addition, on-post recreation, community facilities, public safety and related services are discussed.

The ROI for the proposed action is the Metropolitan Washington regional planning area, as defined by the Metropolitan Washington Council of Governments (MWCOG). This area is comprised of **central jurisdictions** (Arlington County and City of Alexandria in Virginia and the District of Columbia); **inner suburbs** (Montgomery and Prince George's Counties in Maryland and Fairfax County and the Cities of Fairfax and Falls Church in Virginia); and **outer suburbs** (Calvert, Charles, and Frederick Counties in Maryland and Loudoun, Prince William, Stafford Counties, and the Cities of Manassas and Manassas Park in Virginia). [4]

Fort Belvoir is located at the southern edge of Fairfax County, about 4 miles from the Prince William County border, placing it in the inner suburbs.

[4] This 16-jurisdiction area was the Metropolitan Statistical Area (MSA) defined in 1983 by Office of Management and Budgets (OMB) for federal statistical purposes. After the 1990 Census, OMB modified the definition of metropolitan areas and expanded the Washington MSA to the 25-jurisdiction Washington DC-MD-VA-WVA Primary Metropolitan Statistical Area (PMSA), which is currently used in statistics produced by federal agencies. However, MWCOG still produces its annual estimates and forecasts for the 16-jurisdiction MSA as defined in 1983. Where federal statistics for the ROI (MWCOG planning region) are not available, data for the PMSA is presented instead.

The baseline for socioeconomic data is 2001, the date of Fort Belvoir's decision to proceed with planning for an Army RCI project. Where 2001 data were not available, the most recent data available are presented.

4.9.1.1 Economic Development

Despite the economic downturn and lingering effects of 9-11-2001 on the tourism industry, job growth in the Washington area remains stronger and unemployment remains lower, especially in the suburbs, compared to nationwide trends. From 2000 to 2001, employment in the Washington was still growing but at a much slower rate (28,000 jobs added) than from 1999 to 2000 (114,000 jobs added). Between 1997 and 2001, over 57 percent of total job growth was in the inner suburbs, followed by the outer suburbs with 27 percent and the central jurisdictions with 16 percent.

In 2001, at-place employment in the ROI totaled nearly 2.6 million jobs, over half of them in the inner suburbs. The services sector accounted for the largest share of jobs (40 percent) in the region, followed by government (22 percent) and retail trade (15 percent) (MWCOG, 2002).

MWCOG Round 6.2 Cooperative Forecasts predict that the region's principal employment centers will remain in the inner suburbs with 32 percent of jobs in 2025, and central jurisdictions with 50 percent of jobs, while the outer suburbs are expected to provide 18 percent of all jobs in 2025 (MWCOG, 2002).

In 2001, the average annual unemployment rate in the entire Washington, DC-MD-VA-WV PMSA was 3.1 percent, down from 3.7 percent in 1997. In February 2003, the unemployment rate for the PMSA was 3.7 percent, placing the area at 32nd (lowest) for unemployment among 331 metropolitan areas nationwide. By comparison, unemployment in March 2003 was 6.4 percent in the District of Columbia, 4.5 percent for the state of Maryland and 4.2 percent for the state of Virginia (BLS, 2003).

In 2000, Fairfax County has the highest per capita income in the region at $51,227, while the per capita income for the ROI was $40,970 (MWCOG, 2002). Median income in Fairfax County was also the highest in the region at $81,050 (2000 Census).

The median household income of Fort Belvoir residents living on North Post (Census tract 4219) and South Post (Census tract 4162) was $33,266 and $46,675, respectively.

Commercial construction declined during 2001 compared to prior years, with developers breaking ground on 32.2 million square feet of space, compared to 48.6 million square feet in 2000. The most new construction was in Fairfax County, with 7.6 million square feet of commercial space (MWCOG, 2002).

Retail sales totaled $56.5 billion in 2001, a slight increase over 2000, but when adjusted for inflation were slightly less than retail sales in 2000 of $57 billion. Sales in the region increased by 10.1 percent from 1997 to 2001, compared to 14.4 percent increase nationwide (MWCOG, 2002).

4.9.1.2 Demographics

In 2001, the total population of the ROI was estimated at over 4.6 million people, up from 4.5 million at the 2000 Census. The majority (59 percent) of these people lived in the inner suburbs, while 22 percent live in the outer suburbs and 19 percent in the central jurisdictions. Fairfax County is the largest single jurisdiction, with a population of 0.98 million (MWCOG, 2002).

From 1997 to 2001, population in the ROI grew by a total of 362,100 (8.5 percent). The inner suburbs claimed the largest share of this growth, with a net gain of 164,800 people, followed by the outer suburbs with 135,200 more people and the central jurisdictions with 62,100 more people. Loudoun County was the single jurisdiction with the greatest proportional increase at 38.5 percent (MWCOG, 2002).

Although the outer suburbs are showing the highest rate of growth (15.1 percent from 1997 to 2001), the inner suburbs are expected to remain the ROI's most populous area. According to MWCOG forecasts, the population of the ROI is expected to be around 5.1 million by 2010, with 58 percent of those people living in the inner suburbs, and will reach 5.9 million by 2025, with 54 percent in the inner suburbs (MWCOG, 2002).

At the 2000 Census, the total resident population of Fort Belvoir (Census tracts 4162 and 4219) was7,260 persons, of which 44 percent were children under 18 years of age and 33 percent were school-age (5 to 18 years). Of the total population, 292 people (4 percent) were living in group quarters (i.e., barracks) and the rest were living in households. There were 1,817 families and 57 non-family households living on Fort Belvoir at the 2000 Census.

The demographic profile of military residential communities tends to differ from that of the general population, due in part to the ages of active-duty service members. The average household size on Fort Belvoir was 3.71 persons, while the average household in Fairfax County was 2.73 persons. The average family size on Fort Belvoir was 3.82 persons, compared to the average family size of 3.2 persons in Fairfax County. On Fort Belvoir, 86 percent of households had children under 18 years, compared to 39 percent in Fairfax County. There were no households on Fort Belvoir with members over 65 years, compared to 21 percent in Fairfax County.

4.9.1.3 Housing

Fort Belvoir currently provides 2,070 family housing units for military service members and their families. Table 4-21 is a summary of the numbers of housing units and bedrooms currently available for officers and enlisted personnel. The existing family housing on Fort Belvoir is described in Section 2.2.1.2 and proposed changes to housing are described in Section 2.2.2.

TABLE 4-21
Fort Belvoir Housing Inventory

Family Quarters	Percent	Officer	Enlisted	Total
1 Bedroom	2%	0	48	48
2 Bedroom	28%	6	569	575

TABLE 4-21
Fort Belvoir Housing Inventory

Family Quarters	Percent	Officer	Enlisted	Total
3 Bedroom	47%	182	793	975
4 Bedroom	22%	109	343	452
5 Bedroom	1%	19	0	19
6 Bedroom	0%	1	0	1
Totals	**100%**	**305**	**1,765**	**2,070**

In addition, Fort Belvoir provides billeting for 808 permanent party enlisted personnel, as well as transient lodging consisting of 491 visiting officer quarters, 23 visiting enlisted, and 21 distinguished visitors quarters (Fort Belvoir website, April 2003).

The Fort Belvoir, Fort Myer, Fort McNair and Pentagon 2001 Family Housing Market Analysis (Neihaus, 2002) evaluated the condition and availability of private-sector housing in the housing market area, which was defined by using the standard Army definition of 20 miles and/or 30 minutes to the principal work location in peak traffic. Travel was measured to the south from Fort Belvoir, to the west and north from Fort Myer, and to the east and southeast from Fort McNair. The family housing market area thus defined includes portions of Stafford County, Prince William County, Fairfax County, and cities of Fairfax and Falls Church, Arlington County, Montgomery County, Prince George's County and the District of Columbia.

The family housing market area currently has a total of about 1.3 million housing units, of which 59.3 percent were single-family houses in 2001 (up from about 56.8 percent in 1990) and 39.7 percent are multi-family housing units. About 58.7 percent of occupied housing units in the housing market area are owner-occupied and 41.3 percent are renter-occupied (Neihaus, 2002). Similarly, there were 1.7 million housing units in the ROI at the 2000 Census, 63 percent of which were owner-occupied. The overall vacancy rate for both the housing market area and the ROI was 4.6 percent. Vacancy rate for rental units dropped from 7.5 percent in 1990 to 3.7 percent in 2001 (Neihaus, 2002).

The majority of rental housing (76 percent) in the housing market area has two or fewer bedroom housing units, with only 16.6 percent three-bedroom and 7.3 percent four-bedroom units. Housing quality characteristics of housing units in the housing market area showed that 0.6 percent of units were not connected to reliable water supply and 0.4 percent had neither public sewer service or septic/cesspool, 0.4 percent lacked complete kitchen facilities, and 0.5 percent lacked complete plumbing facilities (Neihaus, 2002).

In the housing market area, 2001 median monthly rents for two-bedroom units were $1,400 per month (in a range of $450 to $4,300), or $1,529 per month including utilities. For three- and four-bedroom rental units, the median rent with utilities was $1,872 and $2,228, respectively. Rental costs varied greatly by location. By comparison, Maximum Acceptable Housing Cost for military service members (BAH plus Out-of-Pocket amount that varies by

grade) in 2001 ranged from $1,068 for JNCOs and JENL (E1-E5) to $2,112 for O6 and higher (Neihaus, 2002).

In the ROI, permits were issued for 32,775 new housing units in 2001, down from 35,030 permits in 2000. Nearly half of the housing permits issued in 2001 were in the outer suburbs, but Fairfax County was the highest single jurisdiction for housing permits, issuing 6,121 permits in 2001 (MWCOG, 2002).

New homes sold in the ROI decreased sharply to 18,958 sold in 2001, down from 22,882 sold in 2000. Housing inflation in the PMSA increased by 3.8 percent between 2000 and 2001, compared to an increase of 4.0 percent nationally (MWCOG, 2002).

4.9.1.4 Quality of Life

Law Enforcement Services

Law enforcement support is provided to the Fort Belvoir community by Military Police of the Provost Marshal Office. The Military Police headquarters are on South Post at Pohick Road and 12th Street. Residents are asked to report any crimes, incidents, accidents or suspicious individuals or activity to the Provost Marshall Office, located in Building 1131. In the case of an emergency, residents should call 911, which will be routed back to Fort Belvoir for response.

The Fairfax County Police Department provides public safety services for the area surrounding Fort Belvoir (Fort Belvoir Post Guide, 2001).

Fire Protection Services

Fort Belvoir has three fire stations on post: No. 65 on South Post; No. 63 on North Post; and No. 66 at Davison Airfield. These stations are staffed by five fire companies (three engine companies, one truck company and one airport crash company), with a total staff of 66 firefighters. During any 24 hour period, at least 21 firefighter personnel are on duty. Emergency medical service (EMS) personnel are trained at least to the level of emergency medical technician (EMT). The installation fire department has three engines and one ladder truck (Fort Belvoir, 2001).

The off-post fire stations (Fairfax County Fire and Rescue Department) closest to Fort Belvoir are the Woodlawn, Lorton, Gunston, and Kingstowne fire stations.

Medical Services

Fort Belvoir's DeWitt Army Community Hospital provides health care services to active and retired military personnel and their families that are residing in Northern Virginia. The DeWitt Health Care System is recognized as the primary care foundation for the Walter Reed Health Care System. The DeWitt Health Care System operates three Family Health Care Clinics located on military facilities, at Fort Belvoir, Fort Myer and Fort A.P. Hill, as well as two off-post Family Health Care Clinics in Fairfax and Woodbridge. These Family Health Care facilities offer primary care appointments on an appointment basis only and accept no walk-ins. The Family Health Center for Fort Belvoir is located in DeWitt Hospital.

DeWitt Army Community Hospital currently has 69 beds (including bassinets) for patient use. The average daily occupancy rate for the hospital is 21 beds, with 405 inpatient visits and 132,439 clinic visits in 2002. Along with the main pharmacy, DeWitt Hospital also

operates a Pharmacy Refill Annex at the Main PX on post. Dental services are available on post for soldiers on active duty. The Logan Dental Clinic had 11,339 visits in 2002. (Fort Belvoir, 2001; Fort Belvoir website, April 2003).

Schools

Fort Belvoir Elementary School has been in operation from September 1998 and replaced three former schools (Cheney, Markham, and Barden) that closed in 1998. Fort Belvoir Elementary is part of the Fairfax County Public School System (FCPS) and is the county's largest elementary school, serving more than 1,300 students from kindergarten through sixth grade. In 2002, total enrollment was 1,338 including 1,208 on-post students. The 136,000-square-foot facility contains four instructional wings with 57 classrooms and numerous resource activity spaces. The media center has with three instructional reading areas, provides a large children's library collection, online catalog and circulation stations, a TV studio, and a fleet of computers for staff and students' use. The school is equipped with Internet access and houses the latest technologies.

Middle and high school students attend off-post Fairfax County schools. Fort Belvoir Elementary feeds into the Mount Vernon High School pyramid and students attend Walt Whitman Middle School. In 2002, 631 military family member school children attended grades 7-12 at off-post schools. Total enrollment in 2002 was 945 students for Walt Whitman Middle School and 1,710 students for Mount Vernon High School. Both of these schools are close to Fort Belvoir and provide school bus service. Students living on Fort Belvoir also have access to other Fairfax County schools through countywide programs and authorized transfers, as well as private and religious schools in the area (Fort Belvoir, 2001; Fort Belvoir website, April 2003; Fort Belvoir Post Guide, 2001; FCPS website, October 2002).

As of the 2000 Census, 87 percent of school-aged children (1,937 of the 2,228 children ages 5-18 years) living on the Fort Belvoir (Census tracts 4162 and 4219) attended public schools. From Fairfax County enrollment data, about 74 percent of students from Fort Belvoir in all schools were in grades Kindergarten through 6th grade (elementary school).

In 2001, FCPS projected stable enrollment of about 1,300 to 1,340 students through the 2005-2006 school year, which is consistent with recorded enrollments from 1999 to 2002. Like many other schools in Fairfax County and the region, Fort Belvoir Elementary has experienced an effective reduction in capacity, due to reduced class sizes and the space needed by special programs. As a result, although the design capacity of the school was 1,500 students, Fort Belvoir Elementary is functionally over-capacity and mobile classrooms are used to provide the necessary extra space (Brady, personal communication, May 21, 2001; Potter, personal communication, June 2003).

Child and Youth Services are available for military families that require child care and preschool educational services. Day care is provided for children of military members and DoD civilian employees, with fee for service depending on family income. The North Post Child Development Center offers 216 full-day care spaces (including kindergarten) and 60 part-day preschool spaces and the South Post Child Development Center offers 190 full-day care spaces and 26 hourly care spaces. The Child Development Centers are also available for developmental assistance. The Family Child Care Office offers professional home day care and after-school care for children ranging from 4 weeks to 12 years of age. School-age child care is also available at Fort Belvoir Elementary School. The McNamara Headquarters

Complex includes another Child Development Center, located near Gate 3, for children whose parents work at the complex (Fort Belvoir, 2001; Fort Belvoir website, April 2003).

Family Support and Emergency Relief

The Fort Belvoir Soldier and Family Support Center assists in improving the quality of life for military families. The center provides a variety of support services programs, including:

- Relocation Assistance services for families departing and newly arriving on post
- The Exceptional Family Member Program provides assistance to families with a special-needs child or spouse.
- The Consumer Affairs/Financial Assistance Program offers financial counseling and consumer education classes
- Information Referral and Follow-up provides resource listings for various agencies in the military and civilian community
- The Family Advocacy Program aims to strengthen family relationships and reduce stress through educational programs and support services.
- The Employment Assistance Program offers employment counseling and other services for job-seekers, as well as medical assistant and secretarial certification programs
- Job assistance, including resume writing, networking, interviewing, and marketing, is offered under the Army Career and Alumni Program, to help transitioning service members and their families
- Army Emergency Relief provides interest-free loans and grants to active duty soldiers and retirees for emergency needs (Fort Belvoir, 2001; Fort Belvoir Post Guide, 2001).

Shops and Services

Fort Belvoir's major shopping area located is the Post Exchange Mall on North Post. This mall encompasses 136,000 square feet and offers a wide variety of Army and Air Force Exchange services. The Fort Belvoir Commissary is open 7-days-a-week and offers a wide variety of produce, fresh meats and seafood, grocery, in-store bakery, and delicatessen items. The North and South Post Shoppettes and the Class Six Store offer residents a variety of convenience foods as well as grocery items including wine, spirits, and beer. The Commissary averaged more than 86,300 customers per month and the Post Exchange averaged 68,400 customers per month in 2002.

The Army and Air Force Exchange Service (AAFES) clothing alteration and shoe repair facility provides military clothing alterations and sewing of insignia for authorized military members. Fort Belvoir also provides a Military Clothing Sales Store. The South Post service station provides gasoline, new tire sales, and batteries. The Dry Cleaner Shop offers a range of laundry and dry cleaning services along with complete in-house alteration service on uniforms and civilian clothing and shoe repair. Two barbershops, one located inside the Post Exchange Mall and the other located at the South Post, and a beauty shop are available for resident use.

A SunTrust Bank branch is available for on-post banking services. The Fort Belvoir Credit Union (FBFCU), a not-for-profit financial cooperative that has been serving the financial needs of the Fort Belvoir community for more than 50 years, offers services such as savings and mortgages to its patrons.

Religious services at Fort Belvoir are provided by Chaplains and their assistants. Daily Mass and Sunday worship are available for Protestants and Catholics. The Chaplain Family Life Center provides a range of pastoral and family counseling programs. Protestant and Jewish religious education programs for youth and adults are available. In 2002, an estimated 152,240 people (yearly average) attended more than 1,700 religious services on Fort Belvoir.

The Joint Personal Property Shipping Office, Washington Area, at Fort Belvoir provides a household goods transit service that ships and receives household goods and baggage for members of the five branches of the armed services and DoD employees and handles entitlements and travel requests.

The Barden Education Center, located next to the proposed New South Post Village parcel, is part of the Army Continuing Education System and provides a wide variety of further advancement courses and a number of colleges and universities offer classes at Fort Belvoir. Fort Belvoir's Van Noy Library provides residents with access to reference materials and Internet-capable computer terminals as well as a Children's Library.

The Veterinary Clinic provides services for pets of active-duty, retired military members, and reservists on active duty (Fort Belvoir, 2001; Fort Belvoir website, April 2003).

The Self-Help Center houses tools, paint, garden supplies, household items and repair materials for use in improving offices and government quarters (Fort Belvoir, 2001; Fort Belvoir website, April 2003; Fort Belvoir Post Guide, 2001).

Recreation

Extensive recreational facilities are available at Fort Belvoir to military personnel, families, and retirees. Recreational facilities occupy 1,006 acres of the installation in areas convenient to the population they serve (Fort Belvoir, 2001). There are two community centers: Kawamura Community Center, which focuses on arts and crafts, and Sosa Community Center, which provides wide-screen TV, musical instruments and lessons, a game room with video games and pool tables, and space for meetings and clubs.

The Fort Belvoir Officer's Club, located in Belvoir Village on a promontory overlooking the Potomac River, offers lunch, dinner, and Sunday brunch. The Officer's Club provides spaces for small seminars, luncheons, or large dinner parties and includes a swimming pool complex. The Community Club, near George Washington Village, offers a restaurant open for lunch on weekdays, provides catering for events on weekends, hosts weekly Bingo parties and offers a Cyber Lounge and Sports Bar with Direct Digital Satellite connection, as well as live point-to-point video conferencing for meetings.

Fort Belvoir's two golf courses on South Post (9 holes) and North Post (36 holes) are foremost recreational resources for the military and retiree community in the area. Three picnic park areas can be reserved for events. The Dogue Creek Marina at River Village provides boat slips and rents watercraft and boats. The ABWR and JMAWR offer trails for hiking and observing wildlife; trails are open to the public and the refuges are made

available for educational programs operated by off-post organizations. The Accotink Bay Refuge Environmental Education Center supports refuge-based educational programs with classroom space and interpretive programs. The installation has indoor and outdoor archery ranges (the latter currently closed for renovation) and makes over 8,000 acres of land available for seasonal bow-hunting (with a state license). Fishing (with a state license) is allowed in the refuges.

Fort Belvoir has many walking and running areas, as well as tennis courts and athletic fields, including several softball fields, six soccer fields and two football fields. The installation has historically made these facilities available to its neighbors, both through ongoing licenses and special events. When local schools in the Washington Metropolitan area were canceling outdoor events during the 2002 sniper incident, Fort Belvoir provided a secure environment for local high school football games. On-post Boy and Girl Scout troops and events are allowed to use Fort Belvoir facilities.

Benyaurd Indoor Pool near Gerber Village offers group instruction and private lessons in aqua sports for residents. There are two fitness centers on post and the Specker Field House offers skating. The Fort Belvoir Outdoor Recreation Program at Sosa Community Center rents camping and skiing equipment, bikes and rollerblades. A Skate Park is located between Buildings 1001 and 1003 and safety equipment is available for loan at the Youth Services Building and Sosa Community Center. The installation also offers an automotive shop and a Bowling Center.

The information, ticketing, and registration (ITR) service at Sosa Community Center provides residents with travel information, destinations, airline and train tickets, package tours, and tickets to local entertainment and sporting events (Fort Belvoir, 2001; Fort Belvoir website, April 2003; Fort Belvoir Post Guide, 2001).

Retirement Services

The Retirement Services Office provides counseling services to those that are considering retirement, as well as services and scheduled activities for those that are retired.

Homeless Programs

Fairfax County operates a homeless shelter in an historic building that was formerly the Camp A. A. Humphreys water filtration plant, located on Route 1 outside Tulley Gate. The vacant building was renovated and leased to the county in 1986 (ICRMP, 2001).

4.9.1.5 Environmental Justice and Protection of Children

Environmental Justice

On February 11, 1994, President Clinton signed EO 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations." The purpose of this order is to require each federal agency to identify and address any disproportionately high and adverse environmental or economic effects that its programs and policies might have on minority or low-income populations. Environmental Justice: Guidance Under the National Environmental Policy Act (CEQ, 1997) defines minorities as members of the following population groups: American Indian or Alaskan Native; Asian or Pacific Islander; Black or African American; or Hispanic. (Persons of Hispanic or Latino origin may be members of any racial group. Nationwide, in 2000 about 14.2 percent of Whites, 3.0 percent

of Blacks, 1.9 percent of Asians and Pacific Islanders, and 11.0 percent of American Indians and Alaska Natives were of Hispanic origin.) A minority population should be identified where either the minority population of the affected area exceeds 50 percent or is meaningfully greater than the minority population percentage in the general population.

Low-income populations are identified using the Census Bureau's statistical poverty threshold, which varies by household size and number of children. For example, the 2000 poverty threshold for a family of 4 with two children was $17,463. The nationwide poverty rate was 12.4 percent at the 2000 Census and 11.7 percent in 2001 (US Census website, accessed April 2003). The Census Bureau defines a "poverty area" as a Census tract where 20 percent or more of the residents have incomes below the poverty threshold and an "extreme poverty area" as one with 40 percent or more below the poverty level (U.S. Department of Commerce, Bureau of the Census, 1995).

To provide the baseline against which any environmental justice impacts can be identified and analyzed, Table 4-22 presents demographic information on race, ethnicity, and poverty status in the Census block groups surrounding Fort Belvoir to the east and north, closest to the housing development villages, as well as Accotink Village, which is located across Route 1 from Tulley Gate and is entirely surrounded by Fort Belvoir's North Post except for where it fronts Route 1. Block groups are subsets of Census tracts and represent the level at which disproportionate impacts would be most noticeable. Statistics for Fairfax County and the ROI are presented to provide context.

As Table 4-22 shows, Fort Belvoir's residential population and two of the adjacent areas, the area surrounding Woodlawn Village and Accotink Village, have a higher percentage of minority population than Fairfax County and are similar to the ROI in that regard. Accotink Village has a 58 percent minority population in 2000, which exceeds the ROI's 51 percent. None of the adjacent areas met the definition of a poverty area, but the 15.5-percent poverty rate in Accotink Village was more than three times the countywide poverty rate and more than twice the ROI's poverty rate. The poverty rate on Fort Belvoir was greater than in the civilian areas adjacent to Woodlawn and River Villages, and greater than Fairfax County as a whole, but lower than the poverty rate of the ROI.

TABLE 4-22
Census 2000 Race, Ethnicity and Poverty Status for the Adjacent Area, Fairfax County and ROI

		Census Block Groups in Areas Adjacent to Housing				
	Fort Belvoir[1]	Accotink Village[2]	Adjacent to River Village[3]	Adjacent to Woodlawn Village[4]	Fairfax County	ROI
Total population	7,260	390	3,461	8,014	969,749	4,544,944
Hispanic or Latino[5]	10%	8%	3%	11%	0%	9%
Not Hispanic or Latino:						
White	51%	42%	89%	53%	70%	58%
Black or African American	31%	36%	3%	26%	9%	27%
American Indian and Alaska Native	0%	1%	0%	0%	0%	0%

TABLE 4-22
Census 2000 Race, Ethnicity and Poverty Status for the Adjacent Area, Fairfax County and ROI

		Census Block Groups in Areas Adjacent to Housing				
	Fort Belvoir[1]	Accotink Village[2]	Adjacent to River Village[3]	Adjacent to Woodlawn Village[4]	Fairfax County	ROI
Asian	2%	9%	3%	6%	13%	7%
Native Hawaiian and Other Pacific Islander	1%	0%	0%	0%	0%	0%
Some other race	1%	0%	0%	0%	5%	4%
Two or more races	3%	4%	1%	3%	4%	3%
Total minority population	49%	58%	11%	47%	30%	51%
Poverty rate	6.2%	15.5%	1.3%	4.5%	4.5%	7.0%

1. Tract 4219, Block Group (BG) 1 and Tract 4162, BG 1
2. Tract 4220, BG 2
3. Tract 4161, BG 1 and BG 2
4. Tract 4218, BG 1 and 2, Tract 4217, BG 1, and Tract 4212, BG 1
5. Persons of Hispanic or Latino origin can be of any "race"
Source: U.S. Census American FactFinder website < http://factfinder.census.gov>

4.9.1.6 Protection of Children

On April 21, 1997, the President issued Executive Order 13045, "Protection of Children from Environmental Health Risks and Safety Risks," which seeks to protect children from disproportionately incurring environmental health or safety risks that might arise as a result of government policies, programs, activities, and standards. Children are present at Fort Belvoir both as residents of family housing and as visitors (daily in Child Development Centers, as users of recreational facilities, in Scout groups and school field trips, etc.). The Army routinely takes precautions for their safety by a number of means including, but not limited to, the use of fencing, limitations on access to certain areas, and provision of adult supervision.

As discussed in Section 4.12, previous investigations found hazardous materials (ACM and LBP) to be present in many of the housing units on Fort Belvoir. These materials were widely used in the building products industry and for housing maintenance for many years. The presence of these materials in the housing units does not constitute a health hazard under normal circumstances, however, and the materials are removed or encapsulated as units are renovated. Fort Belvoir also conducts resident outreach to increase awareness of how parents can reduce potential LBP exposure in the home. Mold is also present in some houses on Fort Belvoir and reports of mold problems are addressed on a case-by-case basis.

4.9.2 Consequences

4.9.2.1 Proposed Action

Economic development

Short-term minor beneficial effects would be expected. In the short term, the expenditures and employment associated with construction of new housing would increase the sales

volume, employment, and income in the ROI, as estimated by the Economic Impact Forecast System (EIFS) model results. Table 4-23 displays the rate of direct and induced economic growth during Year 2 of the IDP, which is when the greatest construction expenditures are anticipated. The EIFS model, its inputs, outputs, and significance measures (Rational Threshold Values or RTVs) are discussed in more detail in Appendix G. These economic benefits would be temporary, lasting only for the duration of construction. These changes in specific economic parameters would fall well within historical fluctuations, as represented by the RTVs shown in Table 4-23, and would be considered very minor.

In Year 1, the privatization of family housing operations would result in the loss of 4 housing inspector government jobs in the Fort Belvoir Housing Office and 55 contractor jobs in housing maintenance. These functions would be replaced by 60 to 70 FBRC property management and maintenance personnel, resulting in a net increase of 11 to 21 permanent jobs. In addition, throughout the 8-year IDP, FBRC would employ 5 to 10 property development staff. These changes will not result in any appreciable changes in regional economic indicators (Appendix G).

TABLE 4-23
EIFS Construction Model Output for the Proposed Action at Fort Belvoir

Indicator	Projected Change	Percentage Change	RTV Range
Direct Sales Volume	$37,965,580		*N/A*
Total Sales Volume	$94,913,940	0.06%	–4.44% to 11.74%
Direct Employment	167		*N/A*
Total Employment	416	0.02%	–2.76% to 3.55%
Direct Income	$8,341,194		*N/A*
Total Income	$20,852,980	0.02%	–11.51% to 3.71%
Local Population	0	0%	–1.38% to 0.79%

Demographics

Minor effects would be expected. The total number of housing units will not change, but the occupancy rate is expected to improve. Therefore, at the end of the initial development period when all the new and rehabilitated housing is available, the total population living in family housing at Fort Belvoir could increase somewhat.

In recent years (1999 to 2003), the occupancy rate of Fort Belvoir's family housing has ranging from a low of 77 percent (in 1999) to a high of 89 percent (2000 and 2001). At the 2000 Census, household population at Fort Belvoir was 6,968 persons. At 95 percent occupancy, that would equate to about 7,335 persons, an increase of 367 people (5.3 percent) above the 2000 Census. Alternatively, applying the average Fort Belvoir household size of 3.71 persons to a 95 percent occupancy rate on 2,070 units would equate to about 7,290 persons, an increase of 322 people (4.6 percent) over the 2000 Census.

Because there could be a minor increase in on-post population, an increase in demand for additional law enforcement, fire protection services, medical and other services could result from implementation of the proposed action, as discussed below.

Housing

Because the total number of housing units will not increase, there would be no effect on housing supply or demand in the family housing market area. Property taxes are not applicable to RCI housing at Fort Belvoir.

Quality of Life

Long-term minor beneficial effects on quality of life would be expected. The availability of affordable, quality family housing is a key function of quality of life for soldiers and their families. The proposed action would improve the condition and aesthetic appeal of existing housing through replacement and rehabilitation. The supply of 3- 4- and 5-bedroom units on Fort Belvoir would be increased. No adverse effects on the variety of services Fort Belvoir provides to residents, workers, retirees and other visitors are expected.

Because there could be a minor increase in on-post population, a minor increase in demand for law enforcement, fire protection services, medical and other services could result, as discussed below.

Law Enforcement and Fire Protection

Based on resource planning factors for residential development from the Urban Land Institute (Burchell et. al, 1994), a residential population increase of 367 persons could require an additional 0.55 full-time equivalent (FTE) police officers, 0.45 FTE firefighters and 0.04 FTE EMS personnel.

Under the FY 2003 Defense authorization, fire and police are included as services the Army may provide (in accordance with 10 USC 2872a (b)), but FBRC will be required to reimburse the Army for such services (in accordance with 10 USC 2872a (c)).

Medical Services

A minor increase in demand for on-post medical services could result. Based on residential planning factors, a residential population increase of 367 persons could result in an additional 10 EMS calls per year.

The extension of 12th Street will remove some parking spaces used by DeWitt Hospital patrons and an overflow parking lot for the Dental Clinic will be removed to construct New South Village. Temporary replacement parking will be provided, until the Hospital and Dental Clinic are relocated to North Post.

Schools

Fort Belvoir has consulted with Facility and Planning Analysis staff of Fairfax County Public Schools regarding potential effects on county schools from the proposed RCI action. Student generation rates derived from housing units, which is how the County assesses impacts of new construction, are 45-50 percent higher on Fort Belvoir than for in the County as a whole. Even so, based on the number and types of units proposed to be rebuilt/ rehabilitated at Fort Belvoir, County school planning analysis did not project a significant increase in student population from the proposed action (Potter, personal communication, June 2003).

As a rough check on the normal housing unit-based projections, by applying ratios derived from the 2000 Census and assuming that the occupancy rate of Fort Belvoir's family housing will increase to 95 percent, the number of school-age children living in family housing at build-out could be about 2,244 children. Of these, about 1,480 could be elementary school age, or 10 children above the 2000 Census. Assuming 100 percent occupancy (which is not realistic), about 1,558 elementary-school-age children could live on-post, or 218 children above the 2000 Census. However, not all of these would attend public schools; at the 2000 Census, only 87 percent of school-age children living on Fort Belvoir did so.

Fort Belvoir will continue to work closely with Fairfax County Public Schools to address any issues that may arise as a result of RCI at Fort Belvoir.

Family Support and Retirement Services

Services would continue to be provided to residents and retirees by the Fort Belvoir Soldier and Family Support Center and the Retirement Services Office.

Shops and Services

The proposed "live/work" housing units in New South Post Village will provide additional space for leased shops and services in South Post's "Main Street" area, which will benefit residents, workers and visitors on Fort Belvoir. FBRC will work with AAFES, which has first right of refusal for leasing or licensing such operations on the installation, to fill these facilities.

The existing parking lot currently used by the congregation of Belvoir Chapel (Building 1018) will be removed to construct the new Recreation Center, but will be replaced behind that new building.

Recreation

In addition to improving the quality of military family housing, the proposed action will provide five new neighborhood community centers, as well as a new Recreation Center that will be of long-term benefit to the many people who live and work on Fort Belvoir. Existing parks and trails and other outdoor recreation (ballfields, tennis courts, fitness courses, tot lots, etc) in the housing villages will be improved and new facilities will be built in the villages. The existing picnic area on the New South Post Village parcel, which is frequently used by the congregation of Belvoir Chapel (Building 1018), will be enlarged and improved.

A baseball field currently located on the proposed Recreation Center parcel and the Skate Park between Buildings 1001 and 1003 will be displaced by construction of the New South Post Village, but both facilities will be replaced nearby. The Skate Park can easily be moved to the force protection buffer between the new Recreation Center and the parking lot behind it (where Figure 2-14 shows a basketball court).A replacement baseball field is planned on the field just south of the Recreation Center parcel (Figure 2-14).

An adverse effect upon an off-post private recreational organization has been identified. Fort Belvoir currently allows the Woodlawn Little League nonexclusive use of the installation's McNaughton baseball fields located in Woodlawn Village, under a no-cost license issued by USACE. The license is revocable-at-will by the Army and would need to be terminated prior to the closing date of the land transfer to FBRC. The Woodlawn Little League has been invited to combine with the Fort Belvoir Little League and share in the use of other baseball fields on Fort Belvoir and the Fairfax County Recreation Department has

indicated that sufficient baseball fields and parkland exist in the Mount Vernon area to accommodate Woodlawn Little League needs. However, the Army is actively considering transferring this land (approximately 10 acres) to Fairfax County, perhaps in exchange for other County land.

Homeless Programs

The proposed action will have no effect on the Fairfax County homeless shelter near Tulley Gate.

Environmental Justice

Construction impacts are temporary in nature, but they can range from annoying to detrimental for those living near a construction site. Because most of the construction activity would be carried out in the core of the installation, few adverse impacts to low-income and minority communities are expected.

Construction in Woodlawn Village would have minor adverse effects on minority populations in the nearby off-post neighborhoods. Construction traffic along Pole Road will likely be an annoyance. Other direct effects of construction activities (such as fugitive dust and noise) may affect the neighborhood to the south, across Pole Road where the nearest residences are 100-150 feet from the edge of Woodlawn Village. As discussed in sections 4.3, 4.4 and 4.10, the noise, dust, and traffic generated by construction would be minimized through construction plans. Fugitive dust emissions will be minimized throughout the construction period by use of conventional dust suppression and mitigation techniques such as soil erosion and sedimentation control, restrictions on where vehicles can travel onsite, speed controls for construction vehicles and equipment, and watering of exposed soil and demolition debris to control dust. Noise from construction equipment will be controlled by use of appropriate sound-mitigation techniques. Construction traffic during peak hours will be reduced by promoting carpooling and by using centralized construction staging areas.

Construction is not expected to affect the neighborhood to the west of Woodlawn Village, because the nearest residences lie more than 1,000 feet away, on the other side of the vegetated wetland area that separates Woodlawn Village from its western neighbors.

The low-income and minority population within Accotink Village may experience minor adverse effects due to increased construction traffic along Route 1 and entering Tulley Gate, but other direct or indirect effects are not expected, because Accotink Village is not near any of the existing or proposed housing villages. Construction traffic is unlikely to use the narrow Backlick Road (State Route 613), which bisects Accotink Village, instead of Fairfax County Parkway to reach Tulley Gate.

As shown in Table 4-22 above, the off-post neighborhoods near River Village are not considered to be minority communities.

Modernizing housing on Fort Belvoir will result in long-term beneficial effects on the quality of life for low-income and minority residents of military family housing.

Protection of Children

Both short-term minor adverse and long-term minor beneficial effects on the protection of children would be expected.

In the short term, because construction sites can be enticing to children, construction activity could be an increased safety risk. Families living in villages that will be entirely demolished and rebuilt will be relocated before demolition and construction begins, but rehabilitation in Gerber and Belvoir Villages and demolition and reconstruction within Jadwin Village may take place at some units while families continue to live in other housing units. In addition, construction at New South Post Village would take place near an existing Child Development Center and the existing Colyer Village neighborhood.

Barriers and "no trespassing" signs will be placed around construction sites to deter children from playing in these areas. All construction vehicles, equipment and materials will be stored in fenced areas and secured when not in use. During construction, safety measures stated in 29 CFR 1926, Safety and Health Regulations for Construction, and other applicable regulations and guidance will be followed to protect the health and safety of residents on Fort Belvoir, as well as construction workers.

The parking lot that will be removed to build the Recreation Center is also used by patrons of the Child Development Center (Building 1028). It will be replaced behind the new Recreation Center. No effects on the safety of children is expected, because parents and children who use that existing parking lot already have to cross 12th Street to reach it. There is a traffic signal and crosswalk at the corner of 12th Street and Belvoir Road. The loop road that provides direct access to Building 1028 for parents dropping off and picking up children will not be affected.

After reconstruction and rehabilitation is complete, long-term beneficial effects on the health of children would be expected because of reduced potential for exposure to hazardous materials. In 1991, the Secretary of the Department of Health and Human Services called lead the "number one environmental threat to the health of children in the United States" (USEPA, 2003). Hazardous materials (ACM and LBP) identified in Fort Belvoir housing units are currently managed in place, to control exposure and minimize health risks; residents are provided with information about LBP. Potential risks to children living on Fort Belvoir would be further reduced by removal or encapsulation during demolition or rehabilitation activities.

New construction does not use building products containing these hazardous materials. These actions would eliminate children's exposure to these hazardous materials in the new homes and further reduce possible exposure in the historic homes.

The construction of new housing, replacement of heating and air conditioning systems, and correction of existing water infiltration problems in historic housing should reduce residents' exposure to mold and mildew.

4.9.2.2 No Action Alternative

Long-term minor adverse effects would be expected. Continuation of current family housing programs would perpetuate deficiencies in quality of life for some soldiers and their dependents. Availability of family housing that is both affordable and of high quality is a key function of quality of life and is often given high priority by soldiers and their families. Fort Belvoir would continue to perform regular maintenance on existing housing. Future renovation projects, similar to the Dogue Creek project, could occur at some point,

but it would be on a constrained budget and therefore over a longer period of time, compared to the 8-year period under the proposed action.

Health risks to children from LBP and ACM would continue to be controlled by management in place and abatement during renovations and health risks due to mold would continue to be addressed on an as-needed basis.

The no action alternative would not affect installation population or ROI demographics.

4.10 Transportation

4.10.1 Affected Environment

4.10.1.1 Roadways and Traffic

The study area focuses on both on-post and key off-post intersections in the vicinity of Fort Belvoir. Many of the off-post intersections are currently congested during peak travel times, while recent studies and field observation indicate that key on-post intersections have substantial reserve capacity. Analysis of both on and off-post locations is intended to assure that traffic impacts of the proposed housing improvements are adequately measured.

Key roadways that serve the Fort Belvoir area are Interstate 95, U.S. Route 1 (Richmond Highway), and the Fairfax County Parkway. Other roadways that serve localized Fort Belvoir traffic include Telegraph Road, Kingman Road, Woodlawn Road, Beulah Street, and Mt. Vernon Memorial Highway. Major on-post roadways include Pohick Road, Belvoir Road, Gunston Road, and Mt. Vernon Road. (See Figure 2-1.)

Interstate 95 is a north-south freeway approximately 2 miles northwest of Fort Belvoir. The majority of traffic accessing Fort Belvoir from I-95 does so via the Fairfax County Parkway interchange; however, I-95 traffic also accesses the Fort via the Lorton Road and U.S. Route 1 interchanges.

U.S. Route 1 is a major arterial roadway that runs in an east-west orientation near Fort Belvoir. The posted speed limit is 45 miles per hour (mph). Near the post, Route 1 is primarily a four-lane undivided roadway with exclusive turn lanes at major intersections. Access to Fort Belvoir and the majority of the housing villages occur via the Pence, Tulley, and Walker Gates.

Fairfax County Parkway is a four-lane divided major arterial that has both interchanges and at-grade signalized intersections. The Parkway provides ingress/egress to Fort Belvoir via both Route 1 and John J. Kingman Road.

Existing Traffic Volumes

Manual turning movement traffic counts at major intersections serving Fort Belvoir were obtained by others in December 2002 as part of master plan activities being undertaken at Fort Belvoir. These counts were supplemented with counts obtained from the DeWitt Army Community Hospital Replacement Environmental Assessment (July 2002) to provide full coverage of both on and off-post intersections likely to be affected by the proposed housing changes. The DeWitt EA counts were obtained in March and April 2002 during morning and evening peak periods. Since these counts were taken, Beulah Street at Telegraph Road

has been re-opened to traffic. This has resulted in traffic increases and changes in traffic patterns on Kingman Road and on the northern part of the Gunston Road corridor. Volumes used in this study were compared to volumes used in the Gunston Road Corridor Study (Transcore, April 2003).Differences between the traffic volume data were not substantial, thus, the master plan and DeWitt EA counts were used for this study.

For this EA, count data at the following intersections (see Figure 4-9) were used:

- Telegraph Road and Beulah Street (signalized)
- Fairfax County Parkway and Kingman Road (signalized)
- Kingman Road and Beulah Street (signalized)
- Kingman Road and Gunston Road (signalized)
- Gunston Road and Gorgas Road (unsignalized)
- Gunston Road and Pohick Road/12th Street (signalized)
- Gunston Road and Abbott Road (unsignalized)
- Gunston Road and Goethals Road (unsignalized)
- Gunston Road and 18th Street (unsignalized)
- Woodlawn Road and Gorgas Road (signalized)
- Pohick Road and Theote Road (signalized)
- Route 1 and Fairfax County Parkway (signalized)
- Route 1 and Backlick Road/Pohick Road (signalized)
- Route 1 and Belvoir Road (signalized)
- Route 1 and Woodlawn Road (signalized)
- Belvoir Road and 12th Street (signalized)
- Belvoir Road and 18th Street (unsignalized)
- Mount Vernon Memorial Highway and Mount Vernon Road (unsignalized)
- Mount Vernon Road and Hurley Road (unsignalized)

A summary of existing peak hour turn movement counts is provided in Appendix H.

Existing Traffic Conditions

The intersections identified above represent a mix of both signalized and unsignalized locations. Signalized and unsignalized intersection analysis procedures were consistent with other recent EAs completed at Fort Belvoir, and are described below.

Planning level procedures outlined in the in the 2000 Highway Capacity Manual were used to assess the operational status of signalized intersections in the study area. The planning level procedures take into account traffic volume, intersection lane arrangements, signal phasing, and signal cycle length. The operational status of each intersection was assessed based on critical intersection volume to capacity (v/c) ratio thresholds shown in Table 4-24.

TABLE 4-24
Signalized Intersection Operational Status Based on Intersection Volume to Capacity Ratios

Critical v/c Ratio (X_{cm})	Relationship to Capacity
X_{cm} < 0.85	Under capacity
> 0.85 –0.95	Near capacity

TABLE 4-24
Signalized Intersection Operational Status Based on Intersection Volume to Capacity Ratios

Critical v/c Ratio (X_{cm})	Relationship to Capacity
> 0.95 – 1.00	At capacity
X_{cm} > 1.00	Over capacity

For unsignalized intersections, 2000 Highway Capacity Manual procedures were used to calculate levels of service. For all-way stop control intersections, a level of service for the entire intersection is provided. At two-way stop control intersection, a level of service for the stop controlled approaches is provided. For consistency with the planning level approach used at signalized intersections, the capacity status of unsignalized intersections is reported according to the thresholds shown in Table 4-25.

TABLE 4-25
Unsignalized Intersection Operational Status Based on Level of Service

Overall Intersection LOS / Critical Movement LOS	Relationship to Capacity
LOS A to LOS C	Under capacity
LOS D to LOS E	Near capacity
LOS F	Over capacity

The volume/capacity (V/C) ratio and operational status of each of the study area intersections for both the existing morning and evening peak period is summarized in Tables 4-26 and 4-27, respectively.

TABLE 4-26
Signalized Intersection Operational Status Under Existing Conditions

	AM Peak		PM Peak	
Signalized Intersection	V/C Ratio	Capacity Status	V/C Ratio	Capacity Status
Telegraph Road and Beulah Street	0.66	Under Capacity	0.76	Under Capacity
Fairfax County Parkway and Kingman Road	0.70	Under Capacity	**1.12**	**Over Capacity**
Kingman Road and Beulah Street	0.33	Under Capacity	0.35	Under Capacity
Kingman Road and Gunston Road	0.37	Under Capacity	0.64	Under Capacity
Gunston Road and Pohick Road/12th Street	0.41	Under Capacity	0.44	Under Capacity
Woodlawn Road and Gorgas Road	0.32	Under Capacity	0.42	Under Capacity
Pohick Road and Theote Road	0.42	Under Capacity	0.77	Under Capacity
Route 1 and Fairfax County Parkway	**1.11**	**Over Capacity**	**1.03**	**Over Capacity**
Route 1 and Backlick/Pohick Road	0.79	Under Capacity	**1.06**	**Over Capacity**
Route 1 and Belvoir Road	0.79	Under Capacity	0.79	Under Capacity

TABLE 4-26
Signalized Intersection Operational Status Under Existing Conditions

	AM Peak		PM Peak	
Route 1 and Woodlawn Road	0.69	Under Capacity	0.78	Under Capacity
Belvoir Road and 12th Street	0.41	Under Capacity	0.30	Under Capacity

TABLE 4-27
Unsignalized Intersection Operational Status Under Existing Conditions

Intersection	AM Peak	PM Peak
	Capacity Status	Capacity Status
Gunston Road and Gorgas Road	Under Capacity	Under Capacity
Gunston Road and Abbott Road	Under Capacity	Under Capacity
Gunston Road and Goethals Road	Under Capacity	Under Capacity
Gunston Road and 18th Street	Under Capacity	Under Capacity
Belvoir Road and 18th Street	Under Capacity	Under Capacity
Mt. Vernon Mem. Hwy and Mt. Vernon Road	**Over Capacity (Eastbound Approach)**	**Over Capacity (Eastbound Approach)**
Mt. Vernon Road and Hurley Road	Under Capacity	Under Capacity

As indicated in Tables 4-26 and 4-27, the signalized intersections at Fairfax County Parkway/Kingman Road, Fairfax County Parkway/Route 1 and Route 1/Pohick Road all exceed their theoretical capacity during one or more peak periods. Other signalized intersections in the study area are operating well below their theoretical capacity. These results correspond with traffic operations observed in the field.

The unsignalized intersection at Mt. Vernon Memorial Highway and Mt. Vernon Road also operates over capacity, as left turning vehicles from Mt. Vernon Road experience long delays. Other unsignalized intersections operate with reserve capacity available.

4.10.1.2Public Transportation

Public Transportation Near Fort Belvoir

Several modes of public transportation are available in and around the Fort Belvoir area. Commuter rail (provided by Virginia Railway Express [VRE]) and Metrorail service can be accessed via stations a short distance from the post. VRE service is accessed at the Woodbridge station, which is approximately 8 miles from the post. Metro service serving the post is best accessed via Huntington Station on the yellow line or the Franconia/

Springfield station on the blue line. These stations are both approximately 5 miles from the post.

Bus service to/from these rail stations is provided by both Metrobus and the Fairfax Connector bus services. Bus service is also provided to/from Fort Belvoir to many locations along Route 1.

Key bus routes that currently serve the post include:

- **Fairfax Connector Route 202 (Beulah Street Line)**. This route provides service from just off the north post (north of Telegraph Road) to the Franconia/Springfield Metro station and beyond. Weekday service is provided from approximately 5:00 a.m. to 9:00 a.m. and from 3:00 p.m. to 9:00 p.m. Busses are scheduled on approximately 30 minute headways.
- **Fairfax Connector Route 107 (Richmond Highway Line)**. This route provides service primarily along Route 1. The route goes from the Defense Logistics Agency (DLA) building on Fort Belvoir to the Huntington Metro station. Weekday service is provided from approximately 5:00 a.m. to 8:30 a.m. and from 4:00 p.m. to 6:30 p.m. Buses are scheduled on approximately 30 minute headways. Route 105 also provides service along this general route, with stops near Route 1 and Mt. Vernon Memorial Highway.
- **Metrobus Route 9A (Richmond Highway Line).** This route provides service between the Lorton VRE station and the Pentagon Metro station with several stops on Fort Belvoir. A stop is also provided at the Huntington Metro station. Weekday service is provided on approximately 30 minute headways.
- **Metrobus Route 11Y (Mt. Vernon Express Line).** This route provides service from near the Walker Gate to Farragut Square in Washington, D.C. The route travels along the Mt. Vernon Memorial Highway and along the George Washington Parkway. Weekday service is provided on approximately 30 minute headways from approximately 6:30 a.m. to 8:00 a.m. and from 4:30 p.m. to 6:30 p.m.

Planned Roadway Improvements Near Fort Belvoir

There are planned major improvements that will impact intersections included in this analysis. The improvements can be expected to improve traffic operations in the vicinity of Fort Belvoir. Many of these improvements are currently being studied by the Virginia Department of Transportation (VDOT) and are documented in the ***Route 1 Improvements Environmental Assessment***. Due to the unknown timing of the improvements, they are not included in the future year (year 2011) analysis.

Planned roadway improvements in the Fort Belvoir area that are called for in the MWCOG Constrained Long-Range Plan (cited in U.S. Army Garrison Fort Belvoir, July 2002) include:

- Widening of U.S. Route 1 from VA 235 to Telegraph Road from 4 to 6 lanes
- Widening of U.S. Route 1 from Telegraph Road to Lorton Road from 4 to 7 lanes
- Widening of U.S. Route 1 from Lorton Road to Stafford County Line from 4 to 6 lanes
- Widening of Telegraph Road from Beulah Street to Franconia Road from 2 to 4 lanes

Again, due to the unknown timing of these improvements, they are not included in the future year 2011 analysis.

4.10.2 Consequences

4.10.2.1 Proposed Action

The proposed RCI redevelopment will not add additional housing units to Fort Belvoir although the housing types and housing location will change relative to existing conditions. The change in housing density, type, and location could result in additional trips to/from Fort Belvoir.

For purposes of traffic analysis, a net increase of 39 housing units was investigated (for a total of 2,109 units).This does not indicate a commitment or desire to build more than the existing 2,070 units, but is a "worst-case" scenario that reflects the unknown of how many units will be provided within each respective village. The 2,109 units reflects the sum of the highest number of potential units in each village, although the total units at the end of the redevelopment will not exceed the current level of 2,070 units.

Trip Generation as a Result of RCI Development

The number of trips generated by the redevelopment of the Fort Belvoir housing stock is a function of both the type and intensity of development. Estimates of the trip characteristics associated with the proposed housing units on Fort Belvoir were obtained from the Institute of Transportation Engineers (ITE) publication *Trip Generation* (6th edition). This document consists of a compilation and synthesis of trip generation studies from around the country and is the primary source of information on trip generation used by the transportation engineering profession.

No additional housing units are proposed for Fort Belvoir, although the type and location of housing on post is proposed to change. These planned changes do result in a forecast increase in the number of trips to/from Fort Belvoir. Again, the trip generation is based on a "up to" total of 2,109 units, although no more than 2,070 units will ultimately be on the post at the end of redevelopment. The net change in trip generation characteristics for each village on Fort Belvoir is summarized below in Table 4-28.

TABLE 4-28
Projected Change in Trip Generation Characteristics of Fort Belvoir Villages

	Number of Resulting Automobile Trips	
Village	**AM Peak Hour Net Increase/Decrease in Trips**	**PM Peak Hour Net Increase/Decrease in Trips**
Belvoir	5	10
Colyer	30	35
Dogue	0	0
Fairfax	35	45
George Washington	50	70
Gerber	5	0
Jadwin	5	0
Lewis Heights	10	40

TABLE 4-28
Projected Change in Trip Generation Characteristics of Fort Belvoir Villages

Village	Number of Resulting Automobile Trips	
	AM Peak Hour Net Increase/Decrease in Trips	PM Peak Hour Net Increase/Decrease in Trips
Park	10	15
River	-90	-110
Rossell	40	45
Woodlawn	110	160
New South Post	215	270
Total	425	580

Note that the trips generated by the proposed development, which are summarized above, are those expected during the peak period of the adjacent roadway network. Given the commuting patterns of those working for the military, it is likely that many housing residents' trips would take place outside of the existing periods of heaviest congestion on the roadway network (i.e., may start work earlier and arrive home earlier). For this analysis, a worst case condition was assumed where all trips would occur during the adjacent roadway peak.

Trip Directional Distribution

Directional distribution of resident trips to/from Fort Belvoir was based on discussions with current Fort Belvoir residents and observed travel patterns at Fort Belvoir gates. Current travel patterns on Fort Belvoir indicate that approximately 90 percent of residents living on Fort Belvoir travel off-post to/from a place of employment. Although FBRC will take into account personnel stationed at Fort Belvoir in the priority of assignment for family housing, these travel patterns are expected to be largely unchanged for housing units constructed as part of the proposed action.

Most of the off-post automobile trips to/from the south, west and north will use either Route 1 or the Fairfax County Parkway. Trips to/from the east and north are expected to use Route 1 and the Mt. Vernon Memorial Highway. The anticipated trip directional distribution is shown below in Table 4-29.

TABLE 4-29
Trip Directional Distribution for the Proposed RCI Development

Direction	Expected Trip Distribution
North/East via Route 1	25%
North/East via Mt. Vernon Mem. Hwy.	10%
South/West via Route 1	10%
North via Fairfax County Parkway	45%

Internal to Fort Belvoir	10%

Modal Split

For analysis purposes, it is assumed that new trips associated with the RCI development will be automobile based. This assumption is intended to represent the "worst-case" trip generation scenario. Because of the public transportation options available to Fort Belvoir residents, it can reasonably be expected that some of the new housing residents will take advantage of these services.

Traffic Assignment

Vehicle trips were assigned to key roadways to/from Fort Belvoir using multiple paths. Paths and proportions of trips assigned to each path were selected based on the directness of route, perceived existing traffic congestion, and perceived local route preferences.

Vehicles that will be added to the roadway network during peak periods are summarized in Table 4-30. A summary of forecast year 2011 proposed action traffic volumes are shown in Appendix H.

TABLE 4-30
Trips Added to the Roadway Network as a Result of the RCI Development

	Fairfax Co. Parkway		Route 1		Other Streets	
Peak Period	Inbound	Outbound	Inbound	Outbound	Inbound	Outbound
AM Peak	70	125	50	95	30	55
PM Peak	160	100	120	80	70	50

Forecast Year 2011 Build Traffic Conditions

The operational status of both the signalized and unsignalized intersections in the study area was examined for the forecast year 2011 build condition.

Planning-level procedures outlined in the 2000 Highway Capacity Manual were used to assess the operational status of signalized intersections in the study area under forecast year 2011 build traffic. The operational status of each intersection was identified as under capacity, near capacity, at capacity, or over capacity on the basis of the calculated critical intersection v/c ratio. At unsignalized intersections, the calculated level of service for the entire intersection or critical movement at an intersection was reported as under, near, or over capacity.

The operational status of each of the study area intersections for signalized and unsignalized intersections, both the morning and evening peak period, is summarized in Tables 4-31 and 4-32, respectively.

TABLE 4-31
Signalized Intersection Operational Status Under Forecast 2011 Build Conditions

	AM Peak	PM Peak
Signalized Intersection		

TABLE 4-31
Signalized Intersection Operational Status Under Forecast 2011 Build Conditions

Signalized Intersection	AM Peak		PM Peak	
	V/C Ratio	Capacity Status	V/C Ratio	Capacity Status
Telegraph Road and Beulah Street	0.85	Under Capacity	0.98	At Capacity
Fairfax County Parkway and Kingman Road	0.97	At Capacity	**1.49**	**Over Capacity**
Kingman Road and Beulah Street	0.44	Under Capacity	0.49	Under Capacity
Kingman Road and Gunston Road	0.58	Under Capacity	0.93	Near Capacity
Gunston Road and Pohick Road/12th Street	0.62	Under Capacity	0.60	Under Capacity
Woodlawn Road and Gorgas Road	0.46	Under Capacity	0.58	Under Capacity
Pohick Road and Theote Road	0.56	Under Capacity	**1.02**	**Over Capacity**
Route 1 and Fairfax County Parkway	**1.45**	**Over Capacity**	**1.42**	**Over Capacity**
Route 1 and Backlick/Pohick Road	**1.04**	**Over Capacity**	**1.38**	**Over Capacity**
Route 1 and Belvoir Road	**1.12**	**Over Capacity**	**1.04**	**Over Capacity**
Route 1 and Woodlawn Road	0.92	Near Capacity	**1.02**	**Over Capacity**
Belvoir Road and 12th Street	0.54	Under Capacity	0.51	Under Capacity

TABLE 4-32
Unsignalized Intersection Operational Status Under Forecast 2011 Build Conditions

Intersection	AM Peak	PM Peak
	Capacity Status	Capacity Status
Gunston Road and Gorgas Road	Under Capacity	Near Capacity (Northbound Approach)
Gunston Road and Abbott Road	**Over Capacity (Southbound Approach)**	**Over Capacity (Northbound Approach)**
Gunston Road and Goethals Road	Near Capacity (SB Approach)	**Over Capacity (Northbound Approach)**
Gunston Road and 18th Street	Under Capacity	Under Capacity
Belvoir Road and 18th Street	Under Capacity	Under Capacity
Mt. Vernon Mem. Hwy and Mt. Vernon Road	**Over Capacity (Eastbound Approach)**	**Over Capacity (Eastbound Approach)**
Mt. Vernon Road and Hurley Road	Under Capacity	Under Capacity

As indicated in Table 4-31, the four signalized intersections along Route 1 all are expected to exceed their theoretical capacity during one or more peak periods in 2011. The intersections at Telegraph Road/Beulah Street, Fairfax County Parkway/Kingman Road, and Pohick Road/Theote Road are also expected to exceed their theoretical capacity during one or more

peak periods in 2011. These are the same intersections that are expected to be near or exceed their theoretical capacity in the 2011 no-build scenario.

A similar situation exists in regard to the unsignalized intersections (Table 4-32). The intersections at Mt. Vernon Memorial Highway/Mt. Vernon Road, Gunston/Goethals, and Gunston/Abbott are all expected to operate poorly in the 2011 build scenario, just as they operate poorly in the 2011 no-build scenario.

Traffic During Construction

If approved, construction is anticipated to take place between 2004 and 2011. The developer has established a detailed schedule of construction over the 7-year period. During the peak of construction, which is expected to be less than 1 year, approximately 400 construction-related cars a day and three to seven construction/supply trucks a day are estimated to access Fort Belvoir.

Utilizing an anticipated vehicle occupancy rate of 1.8 passengers/vehicle, which represents a higher rate of carpooling typically observed among construction crews, construction activities are expected to add up to 220 cars to the roadway network each day. Unlike trips generated by the housing units, these construction trips are anticipated to occur outside of peak hours of the adjacent roadway network, when the roadways are less congested. The developer is committed to promoting carpooling of work crews and/or establishing an off-post staging area and bussing workers to the construction site.

Surface Transportation Impacts and Mitigation

As a result of the proposed action to renovate and replace units in existing housing areas, there will be increases in traffic on roadways on and surrounding Fort Belvoir. The overall impact of this added traffic is not considered significant. Many study area intersections are expected to be at or exceed their theoretical capacity with or without the proposed action. Additional trips generated by the RCI development do not cause intersections within the study area to exceed their theoretical capacity (see Table 4-33). Even though impacts are not substantial, the developer is committed to working with the garrison and tenants to address incremental contributions of traffic from this project to existing and future traffic problems. In addition, the developer will advocate mass transit opportunities by constructing on-post bus shelters and providing links to transit agency websites that provide bus, Metro and carpooling information.

TABLE 4-33
V/C Ratios and Project Effect

	AM Peak			PM Peak		
Signalized Intersection	V/C Ratio Build	V/C Ratio No Build	Project Effect	V/C Ratio Build	V/C Ratio No Build	Project Effect
Telegraph Road and Beulah Street	0.85	0.85	0.00	0.98	0.98	0.00
Fairfax County Parkway and Kingman Road	0.97	0.89	0.08	**1.49**	**1.44**	**0.05**
Kingman Road and Beulah Street	0.44	0.44	0.00	0.49	0.49	0.00
Kingman Road and Gunston Road	0.58	0.47	0.11	0.93	0.83	0.10

TABLE 4-33
V/C Ratios and Project Effect

Signalized Intersection	AM Peak			PM Peak		
	V/C Ratio Build	V/C Ratio No Build	Project Effect	V/C Ratio Build	V/C Ratio No Build	Project Effect
Gunston Road and Pohick Road/12th Street	0.62	0.53	0.09	0.60	0.57	0.03
Woodlawn Road and Gorgas Road	0.46	0.42	0.04	0.58	0.55	0.03
Pohick Road and Theote Road	0.56	0.55	0.01	**1.02**	**1.00**	0.02
Route 1 and Fairfax County Parkway	**1.45**	**1.42**	**0.03**	**1.42**	**1.33**	**0.09**
Route 1 and Backlick/Pohick Road	**1.04**	**1.02**	**0.02**	**1.38**	**1.35**	**0.03**
Route 1 and Belvoir Road	**1.12**	**1.02**	**0.10**	**1.04**	**1.02**	**0.02**
Route 1 and Woodlawn Road	0.92	0.89	0.03	**1.02**	**1.00**	0.02
Belvoir Road and 12th Street	0.54	0.53	0.01	0.51	0.40	0.11

Planned projects for roadways surrounding Fort Belvoir have the potential to reduce congestion on the roadways serving the area. Plans to add capacity on Route 1 through the study area will reduce congestion along this important thoroughfare. Anticipated congestion at on-post unsignalized intersections can be eliminated with installation of traffic signals and potential changes to on-post roadway access changes (specifically, opening the ramp from Gunston Road to northbound Route 1 during the p.m. peak per the AMC supplemental EA). Appropriate warrant studies should be completed before signal installation. Continued emphasis by the Fort to advocate and utilize mass transit opportunities can also lead to improvements in traffic operations on roadways serving the Fort Belvoir area. New trips generated in this study were assumed to be automobile trips. Even a nominal use of transit has the potential to reduce anticipated congestion. Transit mode shares of ten percent or higher are found in some areas of the Route 1 corridor in Fairfax County. This contrasts with a maximum of two percent that utilizes public transit at Fort Belvoir, based on surveys conducted over the past several years (U.S. Army Garrison Fort Belvoir, May 2002). Plans being developed as part of a Fort Belvoir mass transit study should provide a blueprint for generating additional transit use on post.

4.10.2.2No Action Alternative

Under the no action alternative there would be no change to the housing developments on Fort Belvoir. No action traffic operations were evaluated at study area intersections for the year 2011 study horizon. Although there are planned major improvements in the vicinity of Fort Belvoir, the timing of these improvements is uncertain; thus, the improvements were assumed not to be in place by the 2011 horizon year.

Forecast Year 2011 No-Build Traffic Volumes

Forecast year 2011 background traffic was obtained by growing existing traffic volumes by approximately 3.5 percent per year through the 2011 horizon year. This annual growth rate is consistent with growth rates used in recent Fort Belvoir Environmental Assessments (U.S. Army Garrison Fort Belvoir, July 2002) and is intended to capture growth from other planned improvements being studied on Fort Belvoir. A summary of forecast year 2011 no-action traffic volumes are shown in Appendix H.

Forecast Year 2011 No-Build Traffic Conditions

The operational status of both the signalized and unsignalized intersections in the study area was examined for the forecast year 2011 no-build condition.

Planning level procedures outlined in the 2000 Highway Capacity Manual were used to assess the operational status of signalized intersections in the study area under forecast year 2011 traffic. The operational status of each intersection was identified as under capacity, near capacity, at capacity, or over capacity on the basis of the calculated critical intersection v/c ratio. At unsignalized intersections, the calculated level of service for the entire intersection or critical movement at an intersection was reported as under, near, or over capacity.

The operational status of each of the study area intersections for signalized and unsignalized intersections, in both the morning and evening peak period, is summarized in Tables 4-34 and 4-35, respectively.

TABLE 4-34
Signalized Intersection Operational Status Under Forecast 2011 No-Build Conditions

	AM Peak		PM Peak	
Signalized Intersection	**V/C Ratio**	**Capacity Status**	**V/C Ratio**	**Capacity Status**
Telegraph Road and Beulah Street	0.85	Under Capacity	0.98	At Capacity
Fairfax County Parkway and Kingman Road	0.89	Near Capacity	**1.44**	**Over Capacity**
Kingman Road and Beulah Street	0.44	Under Capacity	0.49	Under Capacity
Kingman Road and Gunston Road	0.47	Under Capacity	0.83	Under Capacity
Gunston Road and Pohick Road/12th Street	0.53	Under Capacity	0.57	Under Capacity
Woodlawn Road and Gorgas Road	0.42	Under Capacity	0.55	Under Capacity
Pohick Road and Theote Road	0.55	Under Capacity	**1.00**	**At Capacity**
Route 1 and Fairfax County Parkway	**1.42**	**Over Capacity**	**1.33**	**Over Capacity**
Route 1 and Backlick/Pohick Road	**1.02**	**Over Capacity**	**1.35**	**Over Capacity**
Route 1 and Belvoir Road	**1.02**	**Over Capacity**	**1.02**	**Over Capacity**
Route 1 and Woodlawn Road	0.89	Near Capacity	**1.00**	**At Capacity**
Belvoir Road and 12th Street	0.53	Under Capacity	0.40	Under Capacity

TABLE 4-35
Unsignalized Intersection Operational Status Under Forecast 2011 No-Build Conditions

	AM Peak	PM Peak
Intersection	**Capacity Status**	**Capacity Status**
Gunston Road and Gorgas Road	Under Capacity	Under Capacity
Gunston Road and Abbott Road	Near Capacity (Southbound Approach)	Near Capacity (Northbound Approach)
Gunston Road and Goethals Road	Under Capacity	**Over Capacity (Northbound Approach)**
Gunston Road and 18th Street	Under Capacity	Under Capacity
Belvoir Road and 18th Street	Under Capacity	Under Capacity
Mt. Vernon Mem. Hwy and Mt. Vernon Road	**Over Capacity (Eastbound Approach)**	**Over Capacity (Eastbound Approach)**
Mt. Vernon Road and Hurley Road	Under Capacity	Under Capacity

As indicated in Tables 4-34 and 4-35, the four signalized intersections along Route 1 are expected to exceed their theoretical capacity during one or more peak periods in 2011. The intersections at Telegraph Road/Beulah Street, Fairfax County Parkway/Kingman Road, and Pohick Road/Theote Road are also expected to exceed their theoretical capacity during one or more peak periods in 2011. Other signalized intersections in the study area are still expected to operate at acceptable levels, but their reserve capacity will be reduced relative to existing conditions.

As under existing conditions, the unsignalized intersection at Mt. Vernon Memorial Highway and Mt. Vernon Road will continue to operate poorly in 2011. The intersections of Gunston/Goethals and Gunston/Abbott are also expected to be near or exceed their available capacity.

4.11 Utilities

4.11.1 Affected Environment

4.11.1.1 Potable Water Supply

The Fairfax County Water Authority (FCWA) is the potable water provider for Fort Belvoir. The distribution system is owned, operated, and maintained by the installation. The installation receives the potable water from three entry locations: FCWA meter vaults/ pump stations on Pole Road, Telegraph Road, and Beulah Road. The Beulah Road location is used primarily for emergency situations, but also supplies water to the North Post golf course and the Defense Communications Electronics Evaluation and Testing Activity (CEETA) facility (US Army Corps of Engineers, June 2002b). The Telegraph Road entry location supplies the South Post and all of the housing villages except Woodlawn and Lewis Heights. The Pole Road entry location provides water to the North Post area and the

Woodlawn housing village. Lewis Heights housing village receives a mix of potable water from the Telegraph Road and Pole Road entry locations.

Approximately 2.2 million gallons of water per day flow through the three entry points (US Army Corp of Engineers, June 2002c). For fiscal year 2002, the housing villages used a total of 230,532 thousand gallons of potable water (Smith, personal communication, June, 2003).

The distribution system components currently include 78 miles of more than 6-inch (15 centimeter [cm]) water main pipes, two pumping stations, four active storage tanks, a chlorination unit, 68 sample stations, and approximately 641 hydrants (US Army Corps of Engineers, March 2000). The pipes consist primarily of a combination of cement, polyvinyl chloride (PVC) and ductile iron. Of the four storage tanks, three are elevated with a 1.3 million gallon (MG) total capacity and one is a ground level tank with a 1 MG capacity. The Telegraph Road entry location supplies two of the storage tanks, one of these two tanks is located in the historic Gerber Village (Tank #188, Capacity - 300,000 gal.) and another (Tank #591, Capacity - 500,000 gal.) is located in an environmentally protected portion of Fairfax Village near the southern limits of the post.

The chlorination system is located on Telegraph Road and is operated by Fort Belvoir. It is operated year round. There are no other water treatment facilities currently at the post. The distribution system may expand to add new lines in the North Post Development area (Bolton, June 25, 2002). Fort Belvoir's water system is anticipated to be privatized in the near future, though the privatization process is not guaranteed to occur. An EA for utility privatization was prepared in March 2000 and a utility privatization update is currently being conducted (Smith, August 30, 2002).

An analysis of the system prepared in 1996 showed that over 70 percent of the potable water system was built in the 1940s and another 7 percent was constructed in the 1950s (US Army Corps of Engineers, June 2002c). In 1998, the housing villages underwent a replacement of pipes with ductile iron pipes (Bolton, June 25, 2002).

Lead and copper sampling is performed every 3 years from 31 selected homes, with the last sampling having been conducted in 2001. The number and location of sample sites are based on Fort Belvoir's population and plumbing conditions. The next scheduled lead and copper sampling event is the year 2004 (US Army Garrision, 2001). There have been no lead detection violations at Fort Belvoir within the last 5 years (Bolton, June 2002).

The installation is considered a consecutive water works system by the state of Virginia, as it buys its water from the county for on-post distribution and also sells water to customers of the post who do not have direct water service connection to the county. These customers include the approximately 15 homes behind the Hess Gas Station on Route 1 outside Tully Gate, the Woodlawn Plantation House, Woodlawn Stables, and Woodlawn Church. The installation's status as a consecutive waterworks requires the installation to produce its own water quality reports. The water quality reports are compiled using monitoring and sampling data from Fairfax County Water Authority and Fort Belvoir's Environmental and Natural Resource Division.

The reports are sent to residents and water customers of the post (Bolton, June 25, 2002). There are no potable wells on the installation property. Any abandoned potable wells have been

closed and filled over the last 2 years. There are five groundwater wells used for irrigation purposes, four at the North Post golf course and one at DLA (Bolton, June 25, 2002).

4.11.1.2Sewer

Fort Belvoir owns and maintains the on-post sanitary sewer system, which is comprised of 382,100 linear feet of service laterals, collection pipes and mains, 1,697 manholes, and 34 lift stations, and two main pumping stations. Fifteen of the lift stations are scattered along the southeastern limits of the post, throughout Belvoir, Fairfax, Dogue Creek, and Gerber Villages (US Army Corps of Engineers, March 2000). The pumping stations were formerly treatment stations until the 1970s and are located at Building #97 (bottom of Jadwin Loop) and Building # 687 (bottom of Tompkins Basin). The post also owns and operates two ferrous sulfate sewage treatment facilities (US Army Corps of Engineers, March 2000).

The piping system is composed of clay, mixed concrete, cast iron, and asbestos, with clay being the primary pipe material. The pipe ranges in size from 24 inches to less than 4 inches with the most common size being 8 inches. Like the other utility systems, most of the wastewater collection system was built in the 1940s. Most of the sewer collection mains are over 20 years old and have been slipped lined to increase the integrity and flow characteristics (US Army Corps of Engineers, June 2002b).

The housing villages are all connected to the post wastewater collection system. For fiscal year 2002, the post collected 151,776 thousand gallons of wastewater from the housing villages (Smith, personal communication, June 2003).

The wastewater from the installation ultimately discharges to Fairfax County's Noman M. Cole, Jr. Pollution Control Plant (formerly the Lower Potomac Pollution Control Plant). There is also a 6,300 gal septic tank at the Golf Course Maintenance Facility on Telegraph Road. This tank does not have a septic field. The sewer system is anticipated to be privatized in the near future, though the privatization process is not guaranteed to occur.

4.11.1.3Storm Water

Fort Belvoir owns and operates the post's storm water system, which consists of mostly open channels that receive sheet flow and point source flow from within the post's 58 subwatersheds. The open channels ultimately discharge to the post's watercourses through approximately 118, 360 linear feet of paved drainage ditches and 315,800 feet of storm drains. A system of catch basins is used to trap sediments and grit. Street cleaning is performed every spring to remove sand and salt that accumulates during the winter months (US Army Garrison, September 2001). The storm sewers ultimately discharge to Pohick, Accotink, or Dogue Creeks, or to the Potomac River.

The installation has a Storm Water Pollution Prevention Plan (SPPP) and will be covered under a Phase II Storm Water permit as a regulated small municipal separate storm sewer system (MS4) in the near future. Fort Belvoir is covered under a general Virginia Pollutant Discharge Elimination System (VPDES) Phase I stormwater permit. The VPDES Phase I permit program governs any construction activity including clearing, grading, and excavation activities, except for operations that results in the disturbance of less than 5 acres of total land area that is not part of a larger common plan of development or sale (Gillett, personal communication, June 2003). The Phase II VPDES program, which also applies to

Fort Belvoir, expands permit coverage to stormwater discharges from construction activity that results in the disturbance of total land area of 1 acre or more. Fort Belvoir also holds a Phase I VPDES permit for stormwater discharges from industrial activity, which includes governance of discharge from four active groundwater pump and treat petroleum remediation systems at Fort Belvoir.

4.11.1.4Energy Sources

Electricity

Electrical power for the main post at Fort Belvoir is provided by Dominion Virginia Power (DVP) from a 34.5 kilovolt (KV) substation. Fort Belvoir owns the entire on-post electrical systems and its appurtenances. Power is transferred from the DVP substation to a Fort Belvoir-owned switching station and distributed to the post at 34.5 KVs through about 78 miles of overhead lines and 83 miles of underground lines. As of 2000, several overhead feeders were used to serve the various areas of the post. A total of ten substations are located throughout the installation to transform power to lower voltage. Fort Belvoir also uses one combination substation and switching station, and three switching stations. Meter information from DVP indicates that the incoming feeders are operating at about 50 percent of capacity. Connected load data indicates that the main 34.5 KV circuits are operating at 50 to 70 percent of capacity (US Army Garrison, September 2001).

The distribution system is composed primarily of overhead, pole-type (conventional open-wire) construction with pole-mounted transformer banks. There is also some underground primary construction using both direct burial and duct-type construction methods. Most of the commercial area is served from the overhead system; a portion of the residential use area is served from the underground system. The average electrical energy requirement for residential housing at Fort Belvoir during fiscal year 2002 was 24.2 million kilowatt-hours (kwhrs) (Mike Smith, personal communication, June 2003).

A large number of the overhead lines run through the southeastern portion of the post to supply Lewis Heights, River, Dogue Creek, George Washington, Colyer, Belvoir, Fairfax, and Gerber Villages. The majority of the overhead lines are located in environmentally protected areas, including a major line extending parallel to John J. Kingman Road and through the forest and wildlife corridor (US Army Corp of Engineers, March 2000).

Underground lines are distributed throughout sections of the post and a large portion are present in an area adjacent to the JMAWR enclosed by Plantation Drive and Pole Road at the northwestern portion of the post. Underground lines are also located in Gerber Village enclosed by Gunston and Belvoir Roads and in the neighboring areas (US Army Corp of Engineers, March 2000).

Fort Belvoir's electrical system is anticipated to be privatized in the near future, though the privatization process is not guaranteed to occur. The privatization agreement will determine the future of a seven-phase upgrade of the power system initiated in 1988 and aimed at removing most of the existing substations while adding new ones only where needed (US Army Garrison, Sept 2001).

Natural Gas

Fort Belvoir's natural gas system is owned and operated by Washington Gas. As of 2000, gas was distributed to the installation through 25 miles of main gas line and 11 miles of service lines mostly servicing the family housing areas. Fort Belvoir has been upgrading its natural gas supply system since 1993 and will continue to do so over the next few years. Improvements include the conversion of facilities from Number 2 and Number 6 fuel oil to natural gas, replacement of old piping, and placement of new lines and meters.

All of the existing housing villages use natural gas in some capacity except Rossell and Woodlawn Villages. The average natural gas requirement for residential housing at Fort Belvoir during fiscal year 2002 was 88 million ft3 (Mike Smith, personal communication, June 2003).

Steam

The existing De Witt Army Community Hospital, Davison Army Airfield, and the larger buildings on Fort Belvoir use steam to provide heat and hot water. Recently built facilities (such as the McNamara headquarters building) and smaller buildings (such as residential units) use individual boilers. Fort Belvoir has four high-pressure and six low-pressure steam plants. The Viron/Pepco Services Partnership maintains and operates the Building 1422 steam plant under the MDW Energy Savings Performance Contract. DynCorp maintains and operates other steam plants and all steam lines. As of 1997, steam was distributed to the Post through 13 mi (21 km) of steam and condensate lines. Most of the piping associated with each central boiler runs underground. Fort Belvoir owns and maintains the entire system (US Army Garrison, July 2002).

A steam line runs through the western portion of the proposed New South Post Village. This steam line will be left in place and an undisturbed buffer (45 feet wide) on either side around the steam line will be maintained.

4.11.1.5Communications

Telecommunication and information services on Fort Belvoir consist of a copper and fiber-optic data-distribution network. The network backbone is a Asynchronous Transfer Mode (ATM) and the telephone switch is Integrated Services Digital Network (ISDN)-capable. The installation owns the entire system, including copper and fiber-optic cables, utility poles, and computerized switchboard systems associated with inter-post and DoD applications. As of 1997, the main telephone switch handled 18,000 telephone lines. It could be upgraded to handle up to 45,000 lines (US Army Garrison, September 2001).

Fort Belvoir's housing areas are currently wired with analog telephone lines and cable television. There are currently no modern digital data or fiber-optic connections in the housing areas (US Army Garrision, January 2002). The telephone service at Fort Belvoir is provided by Verizon Telephone. The system is a mainframe interconnecting facility owned and operated by Verizon (US Army Corp of Engineers, March 2002). The cable television provider is the Comcast Company (Mike Smith, personal communication, August 2002).

Each home on Fort Belvoir is equipped with a minimum of two pair of analog telephone wires, allowing for two telephone connections. However, in some of the homes, only one

pair of telephone wires may be currently operational. Residents are responsible for ordering and paying for their own service directly from Verizon (US Army Garrison, January 2002).

Each home also has a cable television wire installed at least up to the outside of the home. In many homes in which previous residents have ordered cable television, the cable is installed inside the home, and residents are required to order and pay for cable television service directly from Comcast (US Army Garrison, January 2002).

4.11.1.6 Solid Waste

Fort Belvoir generates about 10,460 tons (9,490 metric tons) of solid waste per year (Werner, personal communication, July 2002). Household and office building trash is disposed of off-post by a contract hauler to the I-95 Energy/Resource Recovery Facility run by Covanta Fairfax, Inc. Items such as tires, fluorescent lighting, and scrap metal go to DRMO for recycling. Woody waste and leaves are composted at the Post's compost site. Other bulky waste such as appliances and furniture are disposed of at Hilltop Landfill in Fairfax County, as well as construction and demolition debris.

The installation has a mandatory post-wide recycling program that collects white paper, colored paper, newspaper, aluminum cans, tin/steel cans, scrap metal, cardboard, glass bottles, plastic containers, used oil, toner cartridges, and scrap metal at the Building 1089, Recycling Facility. Curbside recycling service currently picks up aluminum cans, plastic bottles, glass bottles, and newspaper. Residents may drop all other items off at Building 1089. Fort Belvoir also has a 10-year Integrated Solid Waste Management Plan, last updated in 1999. The goal of the plan is to reduce materials that must be disposed of by incineration or landfilling. In general, the planning goal is to use integrated solid waste management planning to reduce solid waste management costs and potential environmental impacts. Fort Belvoir has met the plan goals and through its recycling collection program and landscape maintenance practices now recycles more than 50 percent of its solid waste (US Army Garrison, September 2001; DPW&L-ENRD, personal communication, June 2003).

4.11.2 Consequences

4.11.2.1 Proposed Action

Under this program, FBRC will be responsible for all costs of utilities provided to common areas of the project and all vacant units during the entire project period. Further, FBRC will be responsible for all utilities in occupied housing units covered by the project until the units have been rehabilitated or replaced and utility meters (electric, gas, and/or oil) have been installed, and a 12-month consumption record has been established. When these three conditions are met in an entire housing area and appropriate notice is provided to the service member occupant, the service member will become responsible for the cost of utilities (electric, gas, and oil) for their residence (Clark-Pinnacle, March 2003).

After consumption records have been established, an average utility consumption cost will be determined for each housing unit type. The service member will then receive this amount from his housing allowance and be responsible for paying utilities. Should the utility costs exceed the service member's identified utility allowance, the service member will be responsible to pay that amount from basic pay. If the utility bill is less than the calculated

allowance, the service member retains those funds. The remainder of the service member's BAH will go to FBRC as rent (Clark-Pinnacle, March 2003).

FBRC may also install meters to track usage of water and wastewater at individual housing units or may install a master meter at the village entrance. However, in accordance with Army RCI utility policy, it is expected that these utilities will remain a project-level cost.

4.11.2.2Potable Water Supply

All the RCI lease areas will continue to be supplied with water that is purchased in bulk from FCWA. All the villages, other than Woodlawn, will continue to use the Post water distribution systems to transport water to the lease area limits. Woodlawn will continue to be fed from a 10' PVC main from the Commissary elevated tank system. New South Post connects to the post distribution system at two existing 12" mains. One is located in Gunston Road, the other in Belvoir Road. The water distribution system to be constructed within New South Post will interconnect between these two large mains. There is also the potential to connect to a second 12" main in Gunston, for additional looping redundancy, if during final design it is determined to be warranted (Arnold, personal communication, June 2003).

The RCI program, in conjunction with the Master Community Plan, anticipates the utilization of existing water distribution systems. New mains will be constructed per the utility providers' standards in locations where streets are added to service infill homes and connected to existing mains where the streets meet existing streets. New service laterals will be built from the new homes and tied into the existing mains. The new service laterals are anticipated to benefit the overall community by reducing water loss from existing connections, which have degraded (Clark-Pinnacle, March 2003).

The water supply system for the proposed action will conform to applicable Federal and State codes for "Public Water Drinking" systems. These specifications have been adopted to ensure regional options are considered, consummate with public health design criteria, in compliance with existing State statutes and in accordance with good public health engineering practices. Variance may be required in respect to the measure of demand for service, and shall be determined based on actual measured flows (Clark-Pinnacle, March 2003). Any modifications to the water distribution system must be made in accordance with the requirements of Fort Belvoir's waterworks permit and 12 VAC 5-590-10, et. seq.

Demand on potable water supply from home users is not expected to increase appreciably under the proposed action, as there will be no net increase in the number of new homes; therefore the current system capacity is adequate. Water flows from the neighborhood centers, Welcome Center, and Recreation Center have been included in the analysis of the village they are located in. Additionally, per capita usage will decrease with the installation of modern water-efficient control devices such as low flow showerheads, faucets, toilets, and by repacking old pipelines that may allow leakage (Arnold, personal communication, June 2003).

In most of the existing villages, the number of homes is anticipated to be reduced, in which case the existing water piping systems will be replaced with new piping systems within the village boundaries. The few existing villages that may have an increase in density would

only increase the unit count by a small amount. Based on the current maximum densities, the following villages could potentially see an increase unit count as follows:

- Rossell - up to 20 additional homes
- Belvoir - up to 8 additional homes
- Park - up to 16 additional homes
- Jadwin - up to 30 additional homes
- Gerber - up to 14 additional homes

These relatively small potential increases will be accommodated within the existing capacities in the adjoining water lines and within the new water lines to be installed within village areas. When an existing residential area is increased in size, the water distribution system for that area will be studied and, if needed, a new distribution main will be installed beginning at the RCI property line to the location of the new houses. If, as a result of the new development, existing utilities are required to be upgraded beyond the line of that particular residential village, it is proposed that this upgrade work be coordinated with DPW&L (Clark-Pinnacle, March 2003).

For the 1,800 units to be rebuilt or rehabilitated, there will be a significant reduction in water capacity demands. This reduction will be a result of the use of water-saving type fixtures for the toilets, showers, clothes washers, and dishwashers. The reduction is estimated to be 33 percent, as calculated by the water analysis. The pre-development condition assumes 288 gallons per day per household (gpd/household) based on the use of historical data referenced in the attachment. The post-development condition shows 193 gpd/household. The 193 gpd/household compares favorably with current planning numbers used by the Washington Suburban Sanitary Commission (WSSC) for new homes using modern water saving type fixtures. The WSSC figures are 225 gpd/household for single family homes and 178 gpd/household for town homes (Arnold, personal communication, June 2003).

In addition to the homes, the project will include a total of 5 neighborhood centers, one Welcome Center, and one Recreation Center (which includes two pools). The average daily flows for these facilities are 200 gpd for each neighborhood center, 750 gpd for the Welcome Center, and 5,250 gpd for the Recreation Center. These flows are considered with the neighborhoods they are located in (Arnold, personal communication, June 2003).

Water usage from construction activities is estimated to be 3,000 gpd for the concrete batch plant (if utilized); 1,000 gpd for dust control for sitework (only for 2 months if sitework occurring during summer months); and 300 gpd for wash racks (only during first 3 months of sitework in each village).

Under the proposed action, long-term minor beneficial effects would be expected for the potable water supply. Areas of new construction would receive new delivery lines within the development area, providing improved water delivery and reduced water exfiltration and loss. Additionally, existing areas will replace older fixtures with fixtures that use considerably less water.

If, as a result of the new development, existing utilities are required to be upgraded beyond the boundary of that particular residential village, FBRC will coordinate with the installation to bring about this upgrade work. This water utility is expected (but not

guaranteed) to be privatized in the near future, resulting in additional long-term beneficial effects as the system will be fully upgraded.

4.11.2.3 Sewer

Under the proposed action, FBRC anticipates the utilization of existing sanitary sewer mains. New mains will be constructed per the utility providers' standards only in locations where streets are added to service infill homes and connected to existing mains where the streets meet existing streets. New service laterals will be built from the new homes and tied into the existing mains. The new service laterals are anticipated to benefit the overall community by replacing degraded existing connections (Clark-Pinnacle, March 2003).

When an existing residential area is increased in size, the sanitary sewer system for that area will be studied and, if needed, a new main will be installed beginning at the RCI property line to the location of the new houses. If, as a result of the new development, existing utilities are required to be upgraded beyond the line of that particular residential village, it is proposed that this upgrade work be coordinated with DPW&L (Clark-Pinnacle, March 2003).

The sanitary sewer system for the proposed action shall conform to applicable codes for "Design Criteria for Sewerage Systems." These specifications are the guidelines to be used for the comprehensive consideration of domestic sewage collection, treatment, and disposal systems, establishing the minimum design criteria pursuant to existing state statutes pertaining to effluent quality meeting State water quality standards. These criteria are intended to promote the design of facilities in accordance with good public health and water quality engineering practices. Variance may be required in respect to the measure of demand for service, and shall be determined based on actual measured flows (Clark-Pinnacle, March 2003).

Pump Stations

The wastewater flows in South Post essentially flow to either pump station (PS)-97 or PS-687. There are also a number of local smaller pump stations that feed into one of the two major pump stations. These two pump stations are metered and then flow to FCWA facilities.

The pump station (PS-97) currently serves most of South Post, including all the South Post villages other than Gerber. As such, adverse impact of New South Post Village on PS-97 will be minimal considering the reduction in units in the other existing villages. New South Post Village could have up to 260 homes flow to this pump station. However, if 260 units are built in New South Post, then at least 65 fewer units will remain in the various other villages that currently drain to SPS-97. As such, the worst case increase to PS-97 is 195 homes, which amounts to less than 0.10 mgd average flow. This is a small fraction of the existing capacity. While there will be an initial increase in flow to PS-97, an analysis of the pre-development and post-development wastewater flows from the housing areas to PS-97 indicates a final reduction of about 18 percent. There is an existing 12" sewer that these new homes would connect to that drains to SPS-97.The pump station, force main and gravity line to the station are currently handling most of the flows from South Post.

Pump station 687 currently serves the balance of South Post wastewater flows that does not go to PS-97. The wastewater analysis shows that the proposed action is estimated to increase flow to this pump station from 21,888 gpd (0.02 mgd) to 52,678gpd (0.05 mgd). This is an

increase of 31,790 gpd (0.03 mgd). Based on the pump horse power and force main size (three pumps at 40 HP and a 12" diameter force main), the capacity of pump station 687 exceeds 1.0 mgd. The total flows from the RCI areas therefore represent only about 5 percent of the station pump capacity, and the expected increase is only 2 percent of capacity. This very minor increase is not expected to exceed the capacity of the pump station. During final design this will be analyzed in more detail, as well as the past wet weather overflow history, and in the event there is a capacity concern, the pump station will be modified accordingly.

A portion of New South Post will require a new pump station to serve about 64 households. The project will install the new pump station which is expected to in turn flow to PS-687, and has been considered in the analysis of that pump station discussed above.

Pump station 1031 serves a small area of South Post and is located near New South Post Village on Gunston Road. This pump station feeds into PS-687. It is estimated that 151 new housing units will flow to PS-1031, where none flow to it currently. The flow from the housing units is estimated at 29,137 gpd or 0.03 mgd. Based on the pump horse power and force main size (2 pumps at 7.5 HP and a 4" force main), the capacity of PS-1031 exceeds 150,000 gpd (0.15 MGD). This represent up to 20 percent of the total pump station capacity. An increased flow of this magnitude may exceed the current capacity of the pump station. During final design this will be analyzed in more detail, and if needed the pump station will be modified as required to provide the needed capacity.

On North Post, Lewis Heights Village flows to PS-1832. The flows from the RCI area to the pump station will be reduced by about 53 percent, as calculated by the wastewater analysis. Based on pump horse power and force main size (2 pumps at 5 HP and a 4" force main), the capacity exceeds 100,000 gpd. The expected flow after development is 57,888 gpd, so there is sufficient capacity.

Woodlawn Village drains directly to a FCWA sewer collection main, and is metered within Woodlawn before the connection. The flow reduction expected from Woodlawn is approximately 38 percent, as calculated by the wastewater analysis. There will be a decrease in capacity utilization for the FCWA systems that provide service to Woodlawn Village.

Within Fort Belvoir the major components of the wastewater system will see a decrease in capacity utilization as compared to the existing condition, resulting in a long-term beneficial impact. One major on-post wastewater pump station (PS-687) will experience a increase in capacity utilization of 2 percent or less. If needed, and it is not expected, the pump station will be modified during final design to insure capacity utilization does not exceed 100 percent. One small local area pump station (1031) will see an increase in capacity utilization of as much as 20 percent as a result of the New South Post Village. If this proves to exceed the existing capacity of PS-1031 as determined during final design, then the pump station will be modified accordingly to provide the required capacity. The overall impact of the proposed action is expected to be beneficial on the system capacities for wastewater, as areas of new construction would receive new wastewater collection lines within the development area. Additionally, an increase in wastewater is not expected as there will be no net increase in the number of new homes or residents; therefore the system would not be constrained. Effluent is expected to continue to discharge to Fairfax County's Noman M. Cole, Jr. Pollution Control Plant (formerly the Lower Potomac Pollution Control Plant). The

post's wastewater utility is expected (but not guaranteed) to be privatized in the near future, resulting in additional long term beneficial effects as the system will be fully upgraded.

4.11.2.4Storm Water

Both long-term beneficial and short-term minor adverse effects would be expected for surface water as a result of storm water management during the construction of new housing villages. Details regarding storm water consequences are found in Section 4.6.2 of the EA.

4.11.2.5Energy Sources

Electricity

Under the proposed action, long-term minor beneficial effects would be expected for the electric system. This utility is expected (though not guaranteed) to be privatized in the near future resulting in long term beneficial effects as the system will be fully upgraded.

An increase in electricity is not expected under the proposed action as there will be no net increase in the number of new homes or residents; therefore the system would not be constrained. In addition, beneficial effects would result from the construction and rehabilitation of the housing units with the installation of energy efficient materials and systems. New construction will use standard energy-efficient techniques for the walls, roofs, and windows, and rehabilitation will use energy-efficient components to replace the old systems where appropriate. Heating, ventilation, air conditioning, and household appliance systems will be installed that have been designed to meet ENERGY STAR® standards. Energy savings are estimated at 30 percent, as calculated by the energy analysis.

Electrical distribution system for existing villages will consist of a combination of overhead and underground primary service feeders dependant on the area involved and its corresponding type of construction (i.e., new or renovation). New South Post will be powered by the existing 34.5 kV circuit (Circuit 1) that runs overhead along 9th Street to a substation behind the current DeWitt Hospital. According to post personnel, there is sufficient capacity on Circuit 1 and in the substation to handle the new homes in New South Post Village (Sedeski, June 2003). The ability to replace overhead electrical utilities with underground services is being explored for inclusion within the RCI program, but may not be adopted (Clark-Pinnacle, March 2003).

Natural Gas

Though there will be no net increase in the number of new homes or residents, an increase in natural gas usage is expected under the proposed action, as the existing heating oil heating systems in Belvoir and Rossell will be replaced with natural gas heating systems. In fiscal year 2002, the housing units used 127,157 gallons of heating oil, which includes usage from Belvoir, Rossel, and Dogue Villages (Mike Smith, personal communication, June 2003). Since 2002, Dogue Village has been entirely converted to natural gas. The new ancillary buildings (Welcome Center, Recreation Center, and Village Centers will also be powered by natural gas, thereby also contributing to the increase in usage at 273,000 MBH, 864,000 MBH, and 122,000 MBH (each), respectively.

Under the proposed action, long-term minor beneficial effects would result from the construction and renovations of the housing units with the installation of energy efficient

materials and systems. New construction will use standard energy-efficient techniques for the walls, roofs, and windows, and rehabilitation will use energy-efficient components to replace the old systems where appropriate. Heating and ventilation systems will be installed that have been designed to meet ENERGY STAR® standards.

According to the Master Community Plan, the installation anticipates the utilization of gas mains. New mains will be constructed or relocated by the utility provider and shall conform to the code and design criteria established by them. When an existing residential area is increased in size or dramatically rearranged, the gas distribution system for that area will be studied and, if needed, a new gas distribution main will be installed to the location of the new houses by the utility provider. If, as a result of the new development, existing utilities are required to be upgraded beyond the line of that particular residential village, it is proposed that this upgrade work be undertaken by Washington Gas, the utility provider, as is typically done in similar private development projects (Clark-Pinnacle, March 2003).

4.11.2.6 Communications

Under the proposed action, long-term minor beneficial effects would be expected for the communication system. The communication distribution system will be installed underground for all new areas of construction. In areas of rehabilitation, the system will be a continuation of the existing overhead or underground system in place.

The cable television and telephone system will be incorporated into the design of the new developments. Industry standards will be used for the design and construction of these facilities. The CATV distribution system will be installed underground for all new areas of construction. In areas of rehabilitation, the system will be a continuation of the existing overhead or underground system in place (Clark-Pinnacle, March 2003).

4.11.2.7 Solid Waste

Short-term minor adverse effects would be expected from the debris associated with the construction, demolition, and rehabilitation of family housing units over the eight year construction period. The debris would be hauled to an off-post landfill. Some portion of the debris, such as concrete and asphalt pavement will be recycled to the extent practicable. As there will be no increase in the number of residential homes, the proposed action would not increase the quantity of solid waste produced on Fort Belvoir following the eight year construction period.

Under the proposed action, FBRC will participate in Fort Belvoir's recycling program in accordance with federal, state and local policies and regulations. Recycling services will be provided to the housing areas through an outside contractor. If possible, recycled goods from the housing areas will be continue to be received at the installation's recycling facility (Building 1089). If not, information on recyclable items, by weight and/or by volume removed, will be provided to DPW&L on a monthly or quarterly basis for incorporation into the installation's SWARS database (Clark-Pinnacle, June 2003).

4.11.2.8 No Action Alternative

Under the no action alternative, no immediate impacts to the utilities would occur and, consequently, no impacts to storm water systems, natural gas systems, communications, or solid waste would occur. However, for the electric, potable water, and wastewater utilities,

it is expected that long-term beneficial effects would still occur due to the anticipated privatization of these utilities.

4.12 Hazardous and Toxic Substances

4.12.1 Affected Environment

Specific environmental statutes and regulations govern hazardous material and hazardous waste management activities at Fort Belvoir. For the purpose of this analysis, the terms hazardous waste, hazardous materials, and toxic substances include those substances defined as hazardous by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), RCRA, or the Toxic Substances Control Act (TSCA). In general, they include substances that, because of their quantity, concentration, or physical, chemical, or toxic characteristics, may present substantial danger to public health or welfare or the environment when released into the environment. Fort Belvoir has both a Hazardous Waste Management Plan, a Hazardous Waste Minimization Plan, and a Master Spill Plan.

To identify possible areas of storage, release, or where disposal of hazardous substances, or petroleum products or their derivatives has occurred, an Environmental Baseline Survey (EBS) was prepared for those areas at Fort Belvoir considered for RCI project development (CH2M HILL, 2003). The EBS also identifies other existing environmental or safety issues (e.g., asbestos-containing material [ACM] and lead-based paint [LBP]) that would limit or affect the use of property for RCI actions.

4.12.1.1 Uses and Storage of Hazardous Materials

Petroleum, oil and lubricants (POL) products may have a variety of uses, but within the housing areas on Fort Belvoir, they most often provide fuel for the generation of heat and hot water (DPW&L-ENRD, 2003). Newer housing units are heated by electric or natural gas fired boilers. No other hazardous materials, with the exception of small quantities of paint, fuel, and household cleaners purchased by the tenants were noted to be used or present at the housing units on Fort Belvoir. As observed in the random site audits conducted during the EBS (CH2M HILL, 2003), some housing units store and use small quantities (less than 5 gal./pounds) of insecticides, fuel, propane, and cleaning materials. Generally, these items were stored appropriately and in good condition.

Currently, Dyncorp is responsible for the maintenance of the facilities within the RCI foot print. The hazardous materials associated with these maintenance activities, such as paint or solvents, are stored by Dyncorp within their designated storage facility that is not located within the RCI footprint.

Fort Belvoir has approximately 124 known USTs currently in use, of which 27 are regulated, and 186 known ASTs currently in use, of which 8 are regulated. These numbers represent tallies across the installation and are not specific to any area of project consideration area (i.e., not specific to RCI properties) (DPW&L-ENRD, 2003). These regulated and non-regulated tanks contain various substances such as heating oil, diesel fuel, motor gasoline, JP-8, lubricants, used oils, fuel-contaminated water (which is addressed under the RCRA program, not the Virginia DEQ PST program). As part of the Fort Belvoir PMP program, tank tightness testing is performed and removal, replacement, and upgrading of the tanks

are conducted as necessary. All tank replacements are with double-walled, state-of-the-art USTs or ASTs, dependent upon specific project requirements (DPW&L-ENRD, September 2001). As this is an ongoing program, the number of petroleum storage tanks present on post may be less by the time the RCI program would be implemented.

There are no RCRA regulated storage tanks within the RCI foot print. All USTs and ASTs currently in use within the RCI footprint are non-regulated (Compliance Branch Chief, DPW&L-ERND, personal communication, July 2002). The USTs and ASTs present within the RCI foot print are used to store heating oil for the facilities with the exception of one active AST containing diesel for an emergency generator located in Dogue Creek Village and one active AST containing waste oil recovered from an active POL remediation system in Dogue Creek Village. Although the ENRD PMP GIS does not have documented locations of any petroleum storage beyond the information provided for the New South Post Village area, it was common to use heating oil in former barracks for heat and hot water and former motor pool areas have typically been known for spills and petroleum releases (Compliance Branch Chief, DPW&L-ERND, personal communication, 2003).

Lack of a documented petroleum storage tank at a particular location does not preclude the possibility that there may still be a UST that has been closed in-place, or remnants of an historic UST or AST (POL contaminated soil) from some previously unknown UST or AST within the RCI footprint (Compliance Branch Chief, DPW&L-ERND, personal communication, July 2002). No known USTs exist within Fairfax, Jadwin Loop, Gerber, Colyer, or Woodlawn Villages. Currently there are active USTs at each housing unit in Rossell Loop and one active, 4,000 gallon UST in the New South Village Parcel. Known USTs have been removed in Dogue Creek, George Washington, Lewis Heights, River, Park Villages and the New South Parcel and the sites closed, with the exception of a site near Building 900 (PC# 97-3115), in accordance with Virginia State Law. Site closure consisted of removing the USTs and mitigating exposure to human receptors. Removal of all impacted media at these sites may not necessarily have been required in order to have achieved mitigation of exposure for closure.

No known ASTs exist within Fairfax, Jadwin Loop, Gerber, Colyer, Park, River or Woodlawn Villages. Active ASTs for each housing unit are located within Belvoir Village. There is an active AST for the remedial system in Dogue Creek Village. An active AST associated with a backup generator is located in George Washington Village. This location in George Washington Village also had a removed AST.

Pesticides (herbicides, insecticides, and fungicides) are applied, and will continue to be applied, postwide at Fort Belvoir by contractors licensed by the Commonwealth of Virginia to apply these products, including pesticide application on the properties covered in this EA. Pesticides applied by these contractors are stored in the Pest Control Shop, Building 1496.

4.12.1.2Hazardous Waste Disposal

Normal operations at Fort Belvoir generate wastes defined as hazardous by RCRA and state statutes. The management of hazardous waste at Fort Belvoir is conducted in compliance with the Resource Conservation and Recovery Act (RCRA). Fort Belvoir has both a Hazardous Waste Management Plan, a Hazardous Waste Minimization Plan, and a Master

Spill Plan. Fort Belvoir has one RCRA Part B permit from VDEQ for storage of hazardous wastes at two facilities. Neither of these two facilities are located within the RCI foot print.

A variety of hazardous wastes are generated from the normal maintenance and operations of Army programs at Fort Belvoir. The handling of the hazardous waste is tracked by Fort Belvoir's DPW&L office, in accordance with the Hazardous Waste Management Plan. Currently the private contractor responsible for the maintenance of the facilities within the RCI foot print is required to turn all hazardous waste generated from his operations over to the Army for manifesting and disposal at licensed facilities.

In addition, Fort Belvoir implements a post-wide petroleum management program (PMP) to maintain compliance related to petroleum storage, handling, transfer, and remediation with both federal and Commonwealth of Virginia Petroleum Storage Tank (PST) programs (DPW&L-ENRD, 2003).

4.12.1.3 Site Contamination and Cleanup

Within the RCI property sites, one site within Dogue Creek Village, north of unit #900 (PC# 97-3115), is undergoing active remediation of soil contaminated by heating oil leakage from multiple heating oil tanks from various buildings within Dogue Creek Village. The site is currently undergoing pump and treat cleanup for petroleum contaminated soil and groundwater. In addition, a storm drain and a tributary Creek that discharges to Accotink Bay on the New South Parcel were impacted by a release from adjacent properties. As the release occurred on adjacent property it is discussed below.

Five sites near the housing villages are also undergoing active remediation of soil contaminated by heating oil leakage. These active petroleum remediation sites are located adjacent to Gerber Village and Jadwin Loop. The remedial sites are identified as follows: PC# 99-3400 (Building 202), PC# 99-3262 (Building 210), PC# 99-3261 (Building 211), PC# 99-3401 (Building 256) all east of Gerber Village and PC# 99-3170 (Building 247) northwest of Jadwin Loop. Soil vapor extraction/low-pressure bio-venting systems were installed and are currently operating at each site, except at building 247 (discussed below). The liquid petroleum hydrocarbons (LPHs) detected at each of these sites appear to be either isolated in the areas of the former/closed-in-place USTs (Building 202), or within 10 to 20 feet of the former USTs (Buildings 210 and 256).

The Site Characterization Report (SCR) prepared for the site near Building 247, indicates that the highest level of soil contamination is within 40-75 feet of the former tank basins and LPHs have been detected in the water table in a well approximately 100 feet south along Gaillard Road. A Corrective Action Plan (CAP) is currently being completed under the VDEQ Petroleum Program mandates. The anticipated CAP for the site is expected to delineate the extent of contamination (DPW&L-ENRD, 2003).

Per the VDEQ PST Technical Manual, remedial endponts at all corrective action sites are established on a risk-to-receptor basis, because the main objective of a corrective action is to reduce risks to impacted or potentially impacted receptors. If a receptor is not present, the contamination is left in place. The majority of the corrective action sites on Fort Belvoir were closed due to no receptors being present that would be impacted by contamination. There is likelihood that some residual contamination was left in the ground at the closed corrective action sites based upon relative risk factors and lack of receptors.

There are approximately 25 closed corrective action sites within the RCI footprint (2 in Lewis Heights, 1 in George Washington Village, 21 within Dogue Creek, and one within the New South Post Parcel [former Building 1027]). There are approximately 7 closed corrective action sites within proximity to the RCI footprint.

South of the New South Parcel, there are two corrective action sites. The sites are both located south of Twelfth Street along the southwest portion of the RCI foot print. The South Post AAFES commercial gas station, Building 1197 (PC# 93-0295), was closed in 1996. The site was associated with releases from the former dispensing tanks. Closure was achieved following tank removal, site characterization, and compliance monitoring. The site was closed with contamination left in place.

The second site south of the New South Parcel, PC# 02-3144, is currently undergoing site characterization and is associated with a release of heating oil from Building 1197. Heating oil was detected in a creek on the New South Parcel where it receives flow from a storm drain that drains run-off from the Building 1197 area. Site characterization investigations revealed the fuel oil return line for the new boiler installed in the fall of 2001 was not connected to the UST, but found to be discharging to the ground (Site Characterization Report, Building 1197).

The Fort Belvoir RCRA Solid Waste Management Study identified 238 Solid Waste Management Units (SWMUs) on the Installation (CH2M HILL, 1992). None of these SWMUs are located on the 12 existing housing villages or the New South Parcel. Three SWMUs, however, are located within the southern temporary construction support location. Two of these SWMUs (B-01, B-02) are closed, requiring No Further Action (NFA). The status of the third SWMU (L-47), located on the eastern boundary of the southern temporary construction site, is "site inspection/decommission" (refer to Figure 4-10). This status means existing documentation recommends the SWMU be properly decommissioned, inspected for potential contaminant migration pathways, and follow-up actions performed, as appropriate (DPW&L-ENRD, 2003).

Table 4-36 lists the SWMUs located adjacent to or near the existing housing villages, the proposed New South Post Village parcel, and temporary construction sites. The table contains the proximity to RCI properties, brief description of the SWMU and current status as of 1992. Based on personal interviews with DPW&L-ENRD, the status of these SWMUs has not changed significantly since 1992 and they are not expected to have an impact on the RCI foot print.

TABLE 4-36
Nearby Solid Waste Management Units

Proximity to Housing Villages[1]	SWMU ID	SWMU Description	SWMU Status
Approx. 450 ft southwest of Gerber Village	A-04	Former Coal Storage Area	Open
Approx. 200 ft east of George Washington Village	A-8	George Washington Village Landfill	Closed
Approx. 670 ft north of Dogue Creek Village	A-9	Markham School Landfill	Closed
Approx. 100 ft east of George Washington Village	A-16	George Washington Village Landfill Interceptor Trench	Closed
Approx. 400 ft north of Dogue Creek Village	A-17	Markham Landfill Interceptor Trench	Closed

TABLE 4-36
Nearby Solid Waste Management Units

Approximately 94 ft southeast of stone crushing temporary construction site	A-28	Non-authorized Debris Landfill	Open
Within stone crushing temporary construction site (northwest corner)	B-01	Building 625 Hazardous Waste Storage Area	Closed
Within stone crushing temporary construction site (northeast corner)	B-02	Building 627 Hazardous Waste Storage Area	Closed
Approximately 25 ft south of stone crushing temporary construction site	B-03	Building 632 Hazardous Waste Storage Area	Closed
Approximately 175 ft south of stone crushing temporary construction site	B-04	Building 633 Hazardous Waste Storage Area	Closed
Approximately 100 ft south of stone crushing temporary construction site	B-05	Building 633 Hazardous Waste Storage Area	Closed
Approx. 300 ft west of Fairfax Village	B-14, B-15	Building 363A,C – Hazardous Waste Storage Area	Closed
Approx. 360 ft west of Gerber Village	C-11	Building 715 Wash Rack	Open
Approx. 500 ft west of Fairfax Village	D-4, D-5	Building 324 Oil/Water Separators (3)	Open
Approx. 400 ft west of Gerber Village	D-11	Building 715 Oil/Water Separator	Closed
Approx. 310 ft west of Gerber Village	E-13	Building 715 Waste POL Storage Area	Open
Approx. 350 ft southwest of River Village	F-3	Fort Belvoir Marina Aboveground Waste POL Tank	Closed
Approx. 375 ft west of Gerber Village	G-11	Building 714 Underground Waste POL Tank (closed)	Closed
Approx. 250 ft west of Gerber Village	I-04	Building 707 Battery Acid Neutralization Unit (closed)	Closed
Approx. 800 ft east of Jadwin Village	L-11, L-8	Sewage Treatment Plant 2, Drum Storage Area	Open
Within stone crushing temporary construction site (southeast corner)	L-47	600 Area Transformer Storage Pad	Open
Approx. 200 ft southwest of River Village	N-17	Fort Belvoir Marina Battery Storage Area	Open

1. The approximate locations of the SWMUs listed in this table does not include and is not attempting to delineate the extent of contamination or area boundaries. Information concerning extent of contamination from each individual SWMU was not available in the cited references.

Source: U.S. Army Fort Belvoir, Solid Waste Management Unit Study, CH2M HILL, 1992; DPW&L-ENRD, personal communication, 2002.
POL = Petroleum, Oil, and Lubricants

4.12.1.4 Special Hazards

Polychlorinated Biphenyls (PCBs)

PCBs are industrial compounds used in electrical equipment, primarily capacitors and transformers, because they are electrically nonconductive and stable at high temperatures. Because of their chemical stability, PCBs persist in the environment, bioaccumulate in organisms, and become concentrated in the food chain.

Fort Belvoir considers the installation to be PCB compliant (< 50 ppm PCB content in oil cooled electrical equipment) (DPW&L-ENRD, personal communication, August 2002). Fort Belvoir's policy is to sample all transformers for PCB content when they are taken offline for repair or replacement. Due to the size, complexity, and age of the electrical system at Fort Belvoir, the possibility exists that there is non-compliant electrical equipment within the RCI footprint.

Asbestos

Remediation for ACM is regulated by the USEPA and OSHA. Asbestos fiber emissions into the ambient air are regulated in accordance with Section 112 of the CAA, which established the NESHAP. These standards address the demolition or rehabilitation of buildings with ACM.

Two categories are used to describe ACM. Friable ACM is defined as any material containing more than 1 percent asbestos (as determined by polarized light microscopy) that, when dry, can be crumbled, pulverized, or reduced to powder by hand pressure. Nonfriable ACM is material that contains more than 1 percent asbestos and does not meet the criteria for friable ACM.

An in-depth ACM inventory or survey of a housing unit is performed by a licensed asbestos inspector when the residential unit is vacant or under renovation. Vacant quarters are surveyed based on what needs to be renovated (i.e., bathroom, kitchen, utility room, bedroom, etc.).

An asbestos survey was conducted in 1999 of the housing village units by Fort Belvoir. In addition, Fort Belvoir maintains an inventory database of existing asbestos conditions of all housing units on Post. Table 4-37 summarizes the identified asbestos containing construction materials within each housing village and the New South Parcel. Additional detail about asbestos-containing construction materials within each housing unit is provided in the EBS being prepared for the transfer of buildings and leasing of land proposed under RCI (CH2M HILL, 2003).

TABLE 4-37
Asbestos Survey Results

Village	Location of Asbestos Containing Material
Woodlawn Village	Floor tiles in hallways, bedrooms, and within the vinyl flooring in kitchens, laundry rooms, and bathrooms.
Dogue Creek Village[1]	In flue insulation, transit duct under the housing unit slabs, and within the floor tiles in the living rooms and upstairs bedrooms and hallways.
George Washington Village	In the vinyl flooring in the kitchens, utility rooms, and bathrooms and also in the permanent walls and ceilings.
Colyer Village	Within the permanent walls and ceilings and in the vinyl flooring in the bathrooms.
Fairfax Village	Floor tiles in the living rooms and bedrooms and within the vinyl flooring in the kitchens, utility rooms, and bathrooms. Also in the transit duct under the first floor slab of the units.

TABLE 4-37
Asbestos Survey Results

Village	Location of Asbestos Containing Material
Gerber Village	Within the permanent walls and ceilings and within the floor tiles of the bathrooms, kitchens and utility rooms.
Belvoir Village	In the pipe insulation in the basement and crawl space and within the permanent walls and ceilings
River Village	In flex connectors of crawl spaces
New South Post Village Parcel	Building 1001 – within the permanent walls and ceilings.

Source: U.S. Army Corp of Engineers, Asbestos Housing Survey, 2001, DPW&L-ENRD, personal communication, January 2003.

1. Abated during renovation in 2002 (DPW&L-ENRD, personal communication, 2003)

Lead-Based Paint (LBP)

In September 1997, a LBP risk assessment was conducted throughout eleven homogeneous areas of post housing (Dewberry & Davis, 1997). The LBP risk assessment was performed to supplement a previous assessment conducted in September 1995. The homogenous areas included housing units in Belvoir Village, Gerber Village, T-400 Area (Park Village and part of Jadwin Loop), 100 Area, Dogue Creek, Rossell Loop, Jadwin Loop, Fairfax Village, Colyer Village, George Washington Village, River Village, and Woodlawn Village.

The assessment determined that housing units sampled in Gerber Village and Dogue Creek Village had lead exceeding HUD action levels in the paint on the interior painted surfaces. Housing units in Belvoir Village, T-400 Area (Park Village and part of Jadwin Loop), 100 Area, Rossell Loop, Jadwin Loop, Fairfax Village, Colyer Village, George Washington Village, River Village, and Woodlawn Village may have been painted with LBP based on the age of the units, those constructed prior to 1979.

In addition to sampling the painted surfaces, representative soil samples for lead analysis were also collected during the 1997 survey. The soil sample results identified the housing units listed in Table 4-38 as having a lead content above the HUD action level of 400 ppm. For more detailed information concerning the soil survey please refer to the EBS (CH2M HILL, 2003).

TABLE 4-38
Lead Exceedances in Soil (>400 ppm)

Village	Housing Unit(s)
Belvoir Village	6, 13, 14
Lewis Heights	1714
Dogue Creek Village	911, 914
Jadwin Village	451
Gerber Village	136

Source: Department of Army, O&M Plan for Lead Based Paint in Housing at Fort Belvoir, 1997.

An interim control measure was implemented in the Dogue Creek Village areas, to prevent human exposure where lead was detected in the soil. Flower beds were built around the

houses, extending out 2 feet from the foundations of the houses. These flower beds were then filled in with dirt and mulch (DPW&L-ENRD, personal communication, October 2002).

An Operation and Maintenance (O&M) Plan was developed as a response to the 1997 LBP risk assessment. Until screening of all painted surfaces for LBP is conducted, according to the O&M Plan, all paint in the housing units located in Belvoir Village, T-400 Area (Park Village and part of Jadwin Loop), 100 Area, Rossell Loop, Jadwin Loop, Fairfax Village, Colyer Village, George Washington Village, River Village, and Woodlawn Village are assumed to contain LBP.

Pesticides

Pesticides are applied at Fort Belvoir by government personnel and government contractors who are DoD certified and licensed by the Commonwealth of Virginia to apply these products, including pesticide application on the properties within the RCI foot print. For clarification, "post-wide" in this section is considered to be any area that is greater than 50 feet away from any housing unit. Any area within 50 feet of the housing unit is considered residential. All Fort Belvoir Pest Control operations are managed by DPWL-ENRD, except for the Fort Belvoir Golf Course and specific tenant activities (DPWL-ENRD, personal communication, 2003). Approximately 60 percent of the pesticides applied on Fort Belvoir is on the North 36 Golf Course and 20 percent at the South 9 Golf Course. The South 9 Golf Course is located adjacent to the New South Parcel. The types of pesticides used on the golf course include fungicides and herbicides.

All pesticide applicators and contractors on Fort Belvoir comply with the current Fort Belvoir Integrated Pest Management (IPM) and Pest Management Policy Letter. The IPM is a process for achieving long-term environmentally sound pest suppression through the use of a wide variety of technological and management practices. IPM is intended to reduce the use of pesticides and is in accordance with the Army's Pollution Prevention Program.

All pesticides used by the contractors are required to be registered with USEPA for the use intended and to have written approval of the Army. Whenever a new chemical is proposed for use by anyone on Fort Belvoir (except residents), an IPM Form must be filled out and be approved by the Army before the chemical can be applied.

Preventative spraying is not authorized in housing units. Interior pest control within the residential areas is the responsibility of the tenant. Approved self-help products and information brochures are available to all housing residents. (DPW&L-ENRD, personal communication, July 2002). If a pest control problem arises that would requires additional assistance, a service order is submitted to the current in-house facility licensed contractor.

The areas within Fort Belvoir's residential villages in which pests are most commonly encountered include the multiple family housing units and the multiple apartment units. The problem pests include roaches, ants, spiders, and flies. The garbage pickup areas within the residential areas normally attract flies. These pickup areas are cleaned once a month by the tenants and the contractor picks up the containers for comprehensive cleaning every 6 months (DPW&L,ENRD, personal communication, July 2002).

Termiticides

Pesticide data and records from 1995 to present were available for review and information, records prior to 1995 are archived and were not available for review at the during the preparation of the EA. Based on experience at other Army installations, it is probable that chlorinated pesticides were used in the past. Specifically, it can be assumed that chlordane was used on houses built before 1980. At that time, USACE Applications Guidelines instructed that chlordane should be used for termite control. Therefore, it is likely that chlordane was used at select locations (units) requiring termite treatment in the housing villages at Fort Belvoir, except for Woodlawn Village, which was built in 1980-1981. The renovated units in Dogue Creek were gutted down to bare brick walls, so the presence of residual chlordane is unlikely, but cannot be ruled out.

Other chemicals that have been used in the past for termite control include diazinon, malthion, and dursban. Fort Belvoir stopped using dursban in 2001 and as of December 2002, dursban can only be used on the golf course, not in the residential, administrative, or warehouse areas. Fort Belvoir is currently using cypermethrin for termite control (DPW&L-ENRD, personal communication, January 2003).

Mosquito Management

A mosquito management plan is implemented on Fort Belvoir. All IPM mosquito control operations on Fort Belvoir (monitoring, trapping, the reduction of breeding sites and larviciding) are conducted by DPWL-ENRD, Environmental Health and Preventative Medicine, and licensed contractor. No fogging to control adult mosquitoes has occurred on Fort Belvoir in the last 10 years. The mosquito treatments used on Fort Belvoir are only for mosquito larvae (larvicide), to prevent hatching of new mosquitoes.

Larvicides are a type of biological control and are a non-chemical way to control the mosquito population. The larvicide products used on Fort Belvoir include Bti (*Bacillus thuringiensis israelensis*) and Altocid. Bti is applied as a briquette or liquid application to storm drains, culverts, and other breeding sites where the potential exists for it to enter permanent wetlands and tidal waters. Altocid is also applied as a briquette or liquid and is used in all other areas where standing water has created potential breeding sites for mosquitoes.

These larvicide areas are decided by mosquito counts done by the Preventive Medicine Division at Fort Belvoir, who are responsible for the monitoring and trapping of mosquitoes. The larvicide areas currently include Dogue Creek, Little River, Woodlawn Village, George Washington Village and Fairfax Village (DPW&L-ENRD, personal communication, June 2002).

Radon

Radon gas is a naturally occurring, colorless, and odorless radioactive gas that is produced by the decay of naturally radioactive material (e.g., potassium, uranium, etc.). Atmospheric radon is diluted to insignificant levels; however, when concentrated in enclosed areas, radon can present human health risks.

Radon testing for residential buildings was completed in 1991. Radon testing is only required for the residential buildings on Fort Belvoir as required by USEPA, the state of Virginia, and the Army. Two housing units located within the southwest corner of Gerber

Village (VIP Quarters), and one housing unit in Colyer Village were the only residential buildings with recorded elevated radon levels (above 4.0 pico-Curies per liter [pCi/L]). The two units in Gerber Village have been renovated but never used. No radon testing has been done for new or renovated buildings since 1992 (Karl Hezel, personal communication, June 2002). For additional information concerning the radon testing performed and survey results please refer to the EBS (CH2M HILL).

4.12.2 Consequences

4.12.2.1 Proposed Action

This section presents the proposed actions and mitigations, if necessary, to be implemented within the RCI footprint to address existing environmental conditions as well as those conditions, if not properly managed, that could result in an environmental impact to the property. Pursuant to CERCLA 120(h), any prior contamination found at any time during the projects will remain the responsibility of the Army. This section describes the general approach for mitigating environmental impacts during demolition, rehabilitation, and reconstruction activities proposed with the RCI foot print. The EMP, which FBRC will prepare in consultation with DPW&L-ENRD prior to closure will provide procedures. Identification of all the necessary stepwise actions can not be described in detail, as the full range of conditions that could be encountered will not be known until actual construction activities are underway.

4.12.2.1.1 Use, Storage, and Disposal of Hazardous Materials

Housing Demolition and Construction Activities

During the initial demolition and construction activities for each of the housing units within the RCI footprint, FBRC will perform all work in accordance with federal, state, and local laws. FBRC will not store hazardous substances or wastes in the housing villages beyond those materials that are required to perform the required construction activities. FBRC will develop an Army approved Hazardous Waste Management Plan and Spill Prevention Plan for the use, storage and disposal of all hazardous materials brought in or existing on the property. FBRC activities will be coordinated with the Army to minimize disturbance or impacts affecting the current status of SWMU sites, closed POL sites, and ongoing remedial activities on the RCI properties as well as the adjacent properties.

All debris generated as a result of initial demolition or rehabilitation activities at each housing unit will be sampled, classified, and disposed of in accordance with applicable regulations (VDEQ) and the standards of the appropriate licensed off-post receiving facility. To the extent practical, all non-hazardous building debris will be segregated from hazardous debris and handled, stored, and disposed of properly by FBRC (CDMP, 2003).

Hazardous construction debris generated from initial rehabilitation or demolition will be classified, manifested and disposed of in accordance with applicable environmental laws and regulations.

All materials including construction materials, wastes, and potentially hazardous or hazardous wastes will be stored onsite in accordance with all relative and applicable State and Federal regulations. A portion of the erosion control and sediment plan will include requirements for routine inspections of equipment, materials, and waste storage areas to

ensure best management practices are being used to prevent a release of wastes to the environment.

Many of the housing units do contain ACM and LBP, which if not properly managed during demolition could result in a release to the environment. Removal of these constituents will be performed only by qualified personnel in accordance with the EMP. As rehabilitation or demolition and reconstruction of the many of the housing units known to contain ACM and LBP, demolition of ACM and LBP containing materials will likely result in construction debris requiring disposal as a hazardous waste. Disposal of ACM and LBP containing construction debris generated as a result of initial demolition and remediation activities will be manifested under the Army's existing permit(s).

During activities at the northern (panel construction and lumber storage) and the southern temporary construction sites (stone crushing activities and concrete plant), hazardous materials will be generated. All hazardous materials generated at these sites will be stored and disposed of in accordance with relevant and applicable federal and state of Virginia environmental laws. Additionally, temporary construction storage facilities will need to provide for regular site and equipment inspections, and spill control procedures, to ensure that large, stored, on-site equipment does not release petroleum products to the environment.

Housing Operations

FBRC will be expected to apply for their own RCRA small quantity generator permit from Virginia for the operation and maintenance of their facilities. Fort Belvoir will apply to the Department of the Army for a waiver to 10 U.S.C. Sec. 2692 to allow FBRC to store materials on post that contain hazardous constituents. This material will be stored in proper containers or cabinets that will be located in Building 1126. Large quantities of paints, pesticides, cleaning solvents and the like will not be stored on post, because FBRC will subcontract functions such as landscaping, maintenance of lawns, housing turnover cleaning and painting, Recreation Center cleaning and maintenance, and office cleaning to commercial operators, who will be responsible for their own offsite storage and disposal of hazardous materials and wastes. Such materials would be brought on-post the day they are to be used. Any future spills or releases caused by project activities will be the responsibility of FBRC.

4.12.2.2Petroleum Storage Tanks (USTs and ASTs)

If USTs or contamination (soil or groundwater) associated with former USTs or ASTs are found during the construction and demolition activities, the Army, in accordance with CERCLA 120(h), is ultimately responsible for the removal and/or disposal of the USTs, or any soils or groundwater contaminated by them. FBRC may agree to assist in abatement efforts to ensure development schedules are met. This assistance may include removal of USTs in connection with demolition and construction activities. POL-contaminated soil that resulted from prior Army activities (i.e., leakage from Army-owned USTs) will be turned over to the Army to be manifested and handled in accordance with the laws of the Commonwealth of Virginia and the requirements of Fort Belvoir's PMP.

To the extent practicable, all demolition, rehabilitation and new construction activities by FBRC will be coordinated with the Army and directed to minimize impacts to the existing closed, POL sites within the RCI foot print. For areas where disturbance of the closed POL

sites or suspected POL contaminated media is unavoidable, DPW&L-ENRD will coordinate with VDEQ to sample affected media for the appropriate parameters (as required by VDEQ) prior to ground disturbance. In other areas, if previously unknown POL contamination is encountered, the construction activities will be halted until the media is sampled for the appropriate parameters and a Corrective Action Plan (CAP) is filed with VDEQ.

During the rehabilitation efforts at each of the villages, new heating systems will be placed in the units. The energy source for the all new heating systems is planned to be natural gas. The current tanks (USTs and ASTs) located within the villages that currently use oil, will be removed or closed in-place and replaced with the new natural gas heating system. In historic housing areas (Belvoir, Gerber, Jadwin and Park), where ASTs are located in the basements or subfloors of the housing buildings and cannot be removed without impacting the historic structure, the ASTs may be closed in-place. Closure will include purging and capping the AST.

Demolition activities planned for Rossell Loop will include the removal of current USTs (30 total) within the village. These USTs contain No. 2 heating oil which is used for heat and hot water for each unit. According to DPW&L-ENRD, there have been past issues of spills and overfills, which occurred as non-reportable spills. No documentation of spills were located during the file review at VDEQ.

Additionally, Building 1001, located within the New South Post Village parcel will be demolished to provide a space for new housing. Before demolition, the existing 4,000 gallon No.2 fuel oil UST will be decommissioned and closed.

The existing tanks within Rossel Loop and at Building 1001 will be decomissioned and removed according to the requirements of Fort Belvoir's PMP and with extensive coordination with the DPW&L-ENRD.

4.12.2.3 Polychlorinated Biphenyls (PCBs)

Small quantities of PCB waste may be generated during the demolition and/or rehabilitation of the housing units. These PCBs may be contained in the ballasts associated with fluorescent lights. PCBs from inside the housing units will be managed by FBRC in accordance with applicable environmental laws. Management may include components outlining the requirements for resident and worker protection during rehabilitation and demolition. FBRC may create PCB abatement specifications to address fluorescent light ballasts in accordance with applicable environmental laws. No PCB waste will be disposed of on-site. All PCB waste will be manifested and disposed of in accordance with applicable environmental laws and regulations pertaining to PCB waste at the time the waste is disposed.

4.12.2.4Asbestos

FBRC, in accordance with applicable environmental laws, will manage asbestos-containing building materials (ACBM) during rehabilitation or demolition activities. FBRC may create ACBM abatement specifications to address ACBM in accordance with applicable environmental laws and regulations. No ACBM waste will be disposed of on-site. All ACBM waste will be handled, stored and disposed of in accordance with applicable environmental laws pertaining to ACBM waste at the time the waste is generated (CDMP,

2003). In addition, ACBM will only be handled by licensed and qualified personnel during all activities, including demolition, rehabilitation, operations, and maintenance of the facilities within the RCI footprint. FBRC will manage ACBM that remains within buildings in accordance with the installation's current Operations and Maintenance (O&M) Plan until such time as a new O&M plan is required.

4.12.2.5 Lead Based Paint

During rehabilitation work, LBP will be abated on all painted surfaces disturbed by the work. During maintenance, rehabilitation and demolition activities all LBP work will be accomplished by USEPA-certified LBP workers and in accordance with applicable environmental laws and regulations. No LBP waste will be disposed of on-site. All LBP waste will be handled, stored and disposed of in accordance with applicable environmental laws and regulations pertaining to LBP waste at the time the waste is generated (CDMP, 2003).

Elevated levels of lead in soils (> 400 ppm) around some of the housing units have been identified in the past. The Army will be responsible for all abatement and/or disposal of any identified LBP hazard not contained within the structures. FBRC will comply with USEPA/HUD guidelines regarding lead in surface soil in locations that exceed the 400 ppm USEPA/HUD guideline as identified in the 1995 and 1997 LBP assessments performed within the RCI foot print.

FBRC will manage LBP that remains within buildings in accordance with the installation's current LBP Operations and Maintenance (O&M) plan until such time as a new O&M Plan is required.

4.12.2.6Pesticides

Any pesticide contamination found at any time during the project will remain the responsibility of the Army, as appropriate. The Army will remain the owner of contaminated soil and/or building materials during and after remediation and shall ultimately be responsible for its proper disposal and for any claims based upon or relating to the presence and removal of pesticide-contaminated soil and/or building materials introduced to the sites on or before the effective date. Pesticide contaminated soil/wastes may be temporarily staged in a central location on post or appropriate location at each of the sites until the Army can arrange for final disposal.

FBRC will apply pesticides on an as-needed basis only. Pesticides will be applied by contractors licensed in the Commonwealth of Virginia for the purpose of administering pesticides. Pesticide applications will be in accordance with all manufacturers' recommendations and a pesticide management plan that will be reviewed by the Army. FBRC has not included the use of self-help pesticides as part of their Operations Plan and will not make them available to housing residents (CDMP, 2003).

4.12.2.7 Radon

During the rehabilitation process, family housing units potentially subject to radon contamination should be vented. FBRC may mitigate the units identified as having elevated radon levels upon review of existing data. FBRC may also complete a testing program for units that will not be demolished within a year of taking possession and mitigate as

appropriate (CDMP, 2003). New construction in areas susceptible to radon will be tested and may, as necessary, include an engineered control (such as subfloor venting or barriers) to minimize or eliminate radon accumulation.

4.12.2.8 No Action Alternative

Minor adverse effects could occur. Fort Belvoir will continue to manage and address the potential hazards of ACM and LBP in accordance with applicable laws, but abatement may be over a much greater period of time than under the proposed action. Therefore, the possibility of adverse effects must be recognized. No additional adverse effects beyond those currently present from the actual and suspected hazardous or POL materials in the RCI foot print would occur if no rehabilitation, demolition, or new construction was performed. Should rehabilitation, demolition, or new construction be performed by the Army within the RCI foot print, the adverse effects are assumed to be the same as if the activities were performed by FBRC under the RCI program.

4.13 Cumulative Effects Summary

Cumulative effects are defined by the CEQ in 40 CFR 1508.7 as "impacts on the environment which result from the incremental impact of the action when added to other past, present, and reasonable foreseeable future actions regardless of what agency (federal or nonfederal) or person undertakes such other actions."

There are a number of projects involving construction that are being considered on Fort Belvoir in addition to the RCI program. In addition, the Fort Belvoir Master Plan is in the process of being updated and an associated Environmental Impact Statement will be prepared.

Six projects are either ongoing or in the advanced stages of planning and design and likely to proceed to implementation:

- **Relocation of Headquarters AMC personnel**: This project is ongoing. About 1,600 personnel are being relocated from leased space in Alexandria into temporary modular buildings on Fort Belvoir. The temporary site selected for relocation of AMC head-quarters to Fort Belvoir is on the east of the South Post Golf Course and about 2,000 feet north of the proposed New South Post Village parcel. An EA was prepared for this action in May 2002. There will be cumulative effects from short-term construction noise and construction traffic. Headquarters AMC personnel will occupy these temporary facilities for approximately 5 to 10 years, until a location is found where they could be accommodated permanently.

- **New North Post Chapel:** This new structure will be approximately 20,000 sq ft in size, with a 600-seat capacity. It will be built on a 6-acre site adjacent to Lewis Height Village, south of Woodlawn Methodist Cemetery and north and east of the Abbot and Franklin roads intersection. Construction is expected to take place in 2003 - 2004.

- **Replacement of Hospital:** A new Army hospital/medical treatment facility is proposed, to replace the existing 44-year old Dewitt Army Community Hospital on South Post. The preferred site is on North Post, north of the PX and west of Woodlawn Road, about

¾ mile northwest of Lewis Heights Village. An EA was prepared for this action in July 2002. Site preparation and construction would begin in 2004 and the facility would open in 2007. The new facility will focus less on inpatient care and more on emergency care, birthing and outpatient services, to include outpatient and same-day surgery, primary and secondary care, preventive medicine and dental care. On a daily basis, the new hospital would serve an estimated 926 outpatients, 25 inpatients in an observation unit for the emergency room, and 77 dental patients. The existing hospital site and seven buildings (hospital, administrative support, warehouse, the dental clinic, a mental health and preventive medicine building, and an aviation medicine clinic) on South Post would be turned back over to the installation for reuse. The new hospital is not expected to increase trips to the installation beyond those generated by the existing hospital (US Army Garrison, Fort Belvoir, July 2002).

- **Construction of T Block Addition to the Defense Communications Electronics Evaluation and Testing Agency**: DCEETA plans to add 122,000 sq ft of administrative office space to their headquarters building, which is located on North Post roughly 1 mile north of Lewis Heights Village, to accommodate approximately 250 new personnel and to construct a new parking structure on an existing surface parking lot.
- **Fort Belvoir Improvements to DCEETA Infrastructure**: Fort Belvoir proposes to build new infrastructure on North Post that would include remote fuel oil and gasoline delivery, storage and distribution facilities, remote water storage and distribution facilities, and an underground electrical duct bank. The purpose is to improve force protection for critical facility operations in the northern part of the installation.
- **Defense Threat Reduction Center** - Project to construct an additional pod on the DLA Headquarters Building to house 1,354 personnel of the Defense Threat Reduction Agency. This project will include a 982 space, three-level parking deck. Construction scheduled for completion in August 2005. A site on North Post has been designated for overflow parking until project is complete.

Each of these proposed projects individually may not introduce severe adverse impacts, but taken together, the projects have the potential to do so, particularly if mitigation measures do not consider all the proposals together.

Fort Belvoir will employ all possible safeguards to protect the environment during construction of these facilities. Although these projects are scheduled to occur in the same years that family housing is planned to be renovated, and would therefore have some cumulative effects on noise and regional air quality, with the exception of the ongoing AMC Headquarters relocation and North Post Chapel construction, most of the projects are not in the immediate vicinity of the planned family housing construction.

During this period of construction activity, adverse cumulative effects on air quality and the noise environment are expected due to construction projects scheduled to occur concurrently with the family housing construction activities. However, these adverse cumulative impacts to air quality are expected to have occurred even without the proposed RCI action. From a 2002 Air Program brief showing projected 2001-2008 NOx emissions from upcoming projects (not including the RCI proposed action, emissions from 2004-2008 range from 19.8 tpy to 52.2 tpy, without the RCI proposed action. Concurrent projects that

contribute to these emissions include DCEETA, DAAF FS, INSCOM HOT, DTRA, DeWitt Hospital, AMC, Tompkins Basin, Prime Power, Chapel and other miscellaneous sources (DIS-ENRD, August 2001). The combined impact of these sources will most likely cause stationary sources at the post to be subject to nonattainment NSR permitting requirements because of the potential post-wide NOx net increase. Under this condition, new sources would likely be required to use the lowest-achievable emission rate (LAER) technology and obtain emission offsets to satisfy NSR regulatory requirements and reduce overall emissions post-wide. The applicability of NSR requirements as well as General Conformity requirements because of the potential post-wide NOx net increase will need to be reviewed again as these projects reach the air permitting and facility final design stage.

There are not expected to be any cumulative effects on utilities, specifically with regard to the relocation of Headquarters AMC personnel as the AMC building is being powered from a new circuit that was run specifically for the building. As AMC is on a separate circuit there should be no issue relative to power for both the AMC project and the proposed action. Increases in solid waste due to demolition and construction of cumulative projects is expected.

Short-term minor adverse effects would be expected with the introduction of noise generated during the construction and renovation activities. Sensitive receptors to noise include existing occupants within the RCI properties, DeWitt Hospital, administrative offices and commercial areas directly adjacent to the RCI footprint. Additionally, noise produced by the stone crushing temporary construction site may be a nuisance to the animals within the Veterinarian Clinic located 200 feet east of the site. However, because stone crushing activities will generally occur during the project after major demolition activities, the noise generated at this site will be in short duration and intermittent.

Long-term cumulative traffic effects are primarily expected on North Post in association with the DeWitt Hospital and the DCEETA facility. Gunston and Kingman Roads would be expected to see increases in traffic volumes with these facilities. Traffic impacts with the new North Post Chapel are expected to be confined to weekends and other periods outside of peak periods of congestion on area roadways. South Post cumulative impacts are associated with the temporary relocation of the AMC Headquarters. Gunston and Belvoir Roads are expected to see increases in traffic with the relocation of the temporary AMC Headquarters. When the hospital relocates to North Post, local trips to the existing hospital, which is adjacent to Colyer Village and the proposed New South Post Village, would be eliminated (for a time, until new activities were located there). Long-term cumulative traffic effects with the Headquarters AMC relocation, DeWitt Hospital, and other potential projects are accounted for in the background traffic growth assumptions for the 2011 horizon year in the traffic analysis presented in section 4.10 of this EA.

Additionally, there would be adverse short-term cumulative effects on traffic due to the temporary increase in construction traffic. Most construction traffic is expected to utilize the roadway network outside of the peak period of the adjacent roadway system. Peak construction is expected to last less than one year and add up to 225 vehicles to the transportation system in non-peak times. Local, on-post trips could be impacted for short times during construction.

Throughout the construction and renovation activities, long-term beneficial effects would be expected with the removal and proper disposal of all hazardous materials brought in (for construction activities) or existing on the RCI properties (ACM and LBP). FBRC activities will coordinate with the Army to minimize disturbance or impacts affecting the current status of SWMU sites, closed POL sites, and on-going remedial activities on the RCI properties, as well as the adjacent properties.

Increased impervious surface from all of these facilities will result in an increased volume of stormwater runoff, however the proposed stormwater management for each facility is anticipated to provide sufficient mitigation to prevent cumulative adverse impacts.

The new DeWitt Hospital Site is located within Accotink Creek Watershed, subwatershed 30. The RCI project will result in only minor increases in impervious surface within this subwatershed. The AMC headquarters project is split between the Accotink Creek and Accotink Bay watersheds, in subwatersheds 01 and 03. There are no proposed impacts to subwatershed 01 from the RCI Project, therefore there is no increase to cumulative impacts in this area. There are substantial increases in impervious surface from both projects within subwatershed 03, however both projects will mitigate with storm water management in order to prevent an increase in stormwater runoff in this area. No adverse cumulative impacts are expected. Due to the added potential for cumulative impacts in this subwatershed, however, FBRC will specifically target this subwatershed for additional infiltration where practicable. The new North Post Chapel is located immediately adjacent to Lewis Heights. Stormwater from the chapel site will be specifically reviewed during development of the storm water management controls for Lewis Heights to ensure there are no cumulative impacts.

Because there is currently a limited amount of stormwater management in the RCI footprints, there is expected to be a beneficial impact on surface waters as a result of the proposed action. This is not anticipated to change as a result of cumulative effects from other projects under consideration.

Potential impacts to vegetation, wildlife, and wetlands from the RCI project are not expected to significantly increase overall effects from the relocation of DeWitt Hospital and of AMC headquarters and the construction of the New North Post Chapel. Moving the hospital will cause approximately 19 acres of mixed hardwood-pine forest to be cleared. Mitigation for this action is to replace the trees with a 2:1 replacement ration. In addition, according to the DeWitt Hospital EA, the project will cause impacts to less than half an acre of wetlands along ephemeral streams, which will be replaced according to the EA. According to the AMC EA, 21 acres (including a mowed grass, a grass shrub strip, 3 acres of a wooded area and scattered landscape trees) will be impacted. All trees will be replaced at a 2:1 replacement ratio. The DTRA EA states that there will be approximately 1.5 acres of impacts to pine forest, which will be replaced on Fort Belvoir. Therefore, after replacement of lost trees and shrubs, and lost wetlands, significant adverse impacts are not expected. The Hospital site and the Chapel site both drain to the western side of the post, while the closest housing village, Lewis Heights, drains to the east and towards Dogue Creek. In addition, no impacts to vegetation or wildlife are expected from the planned reconstruction at Lewis Heights. Removal of vegetation from the combined projects will be compensated for in accordance with the Fort Belvoir Tree Protection Policy and in consultation with the Fort Belvoir Environmental Office. In addition, all sensitive species on Fort Belvoir are protected

under Federal and State laws and will not be impacted during these construction projects. The Army has a policy of no net loss of wetlands; therefore, all potential impacts to wetlands will be compensated. On-site compensation for lost acreage is the most preferable choice, however, compensation may take place off-post in the same watershed if possible. Replacement of lost functionality will be replaced on Fort Belvoir.

Eleven other major projects are in earlier stages of conceptualization and planning and may or may not eventually be implemented, or different plans may be developed:

- **Future Family Housing under RCI:** As part of the process of updating the Master Plan, the Army and Fort Belvoir will continue to attempt to identify additional land that could leased to the RCI partnership for building additional housing, up to the levels identified by the (then-current) housing market analysis. The Army and FBRC will consider the commercial feasibility of constructing additional housing on Fort Belvoir, environmental commitments made by the Army and Fort Belvoir and other relevant information, before determining whether or not to construct any additional housing. The Army will await the updated Master Plan and the Master Plan EIS (expected in 2004) and will perform additional site-specific NEPA analysis as necessary. River Village is a likely candidate site, as it will be depopulated at the end of this project, but the other potential locations for additional housing have not been determined. However, they are likely to be near existing housing villages and community services. Based on the 2001 Housing Market Analysis, up to 998 additional units could be proposed. However, that number could easily change, because another HMA is due in 2006, and also because both available land and commercial feasibility will be factors in deciding how far FBRC should go in attempting to meet the requirement. Timing is also unknown, but a decision to transfer additional land for housing could not be made until 2005 at the earliest. After completing additional NEPA analysis and amending the CDMP and ground lease, construction would be phased over at least 6 years.

- **JPRA Expansion:** Joint Personnel Recovery Agency is currently housed in Building 358. A 1391 is being prepared for an FY08 project to renovate the existing facility and construct an addition to accommodate increased staff and student load (increase of 55 personnel).

- **ATEC Permanent Headquarters** - ATEC proposes to construct a permanent Headquarters building on Fort Belvoir relocating approximately 750 personnel from leased space in Alexandria (potential FY08 project).

- **South Post Fitness Center** - Project to construct a new state of the art physical fitness center on South Post, which will include an indoor pool and indoor jogging track (potential FY09 project).

- **Museum of the US Army:** Proposals have been under consideration for some time to build a museum on Fort Belvoir that would commemorate the Army's history and exploits. The Army does not currently have a central museum. It is anticipated that the museum would receive up to a million visitors a year. The most likely location is an approximately 50-acre site near the southeast corner of US Route 1 and Belvoir Road, but other sites (including a parcel near Pence Gate that was considered and eliminated from this proposed RCI action) are possible. A support facility and storage site is

tentatively located just south of the existing RCI Office, which would be in between the two proposed RCI central construction staging areas (US Army Garrison, July 2002).

- **Building for US Army Intelligence:** The US Army Intelligence Command is planning to build a new office building and parking structure, to accommodate about 800 personnel, near their existing headquarters building on North Post, east of Beulah Road and south of Kingman Road.
- **Improvements to US Rt. 1:** The Virginia Department of Transportation (VDOT) is considering widening US Route 1 through Fort Belvoir and north to the Capital Beltway. This action would require outgrants of land to VDOT by Fort Belvoir and would affect traffic levels near the post. An EA for this project was completed in May 2003. The *FY 2003-2008 Transportation Improvement Program* does not yet include funding for this project.
- **North Post Transportation Study –** As part of Fort Belvoir's on-going process to evaluate options for increasing force security, this study identified transportation alternatives for the North Post to improve security. Examined were north-south roadway alternatives to replace existing Beulah Street and Woodlawn Road, the potential to completely close the North Post to off-site traffic, and improvements to local off-site roads to accommodate traffic redirected around North Post. The impacts of closing old roads and locating new ones would be evaluated in further environmental documentation if any of the plans proposed in the North Post Transportation Study are pursued.
- **Administrative Park Site Evaluation Report –** In this study, completed in May 2000, several sites were investigated for their potential to accommodate an office park with several million square feet of office space. The sites investigated were located in the EPG, on North Post, and the southwest area of the post south of US Route 1 and west of Pohick Road. No decision has been reached about a preferred site or even whether the proposal will go forward into the next phase of study.
- **Renovation of Dogue Creek Marina –** This proposed project would involve dredging Dogue Creek and replacing the existing Marina facilities. No decision has thus far been made about the economic feasibility of this project. As noted in this EA, the Marina will not be included in the ground lease to FBRC. Fort Belvoir will continue to operate the existing Marina until a decision is made about whether and how to pursue renovation. If renovation is not chosen, the Marina could be demolished and replaced by a waterfront park.
- **Soldier Support Center** - Consolidated community service center (1 stop in/out processing). The future of this project is uncertain.

Should another phase of residential housing construction occur under RCI, based upon land identified by the updated Master Plan (estimated completion in 2004) and commercial feasibility, it is possible that this phase of construction could occur concurrently with the proposed action's construction year of highest air quality impact (2007). This would necessitate another evaluation of General Conformity applicability, in addition to New Source review standards.

Impervious surface would be increased. Stormwater impacts would need to be reviewed for cumulative impacts and additional stormwater mitigation would be required, particularly for those subwatersheds where impervious surface is above or nearing the level that can result in impaired streams. Cumulative impacts to vegetation and wildlife are likely. If a rebuilt River Village is one of the proposed new housing sites, cumulative impacts to floodplains are possible.

If up to 988 additional housing units are proposed, that could bring over 3,000 new residents to the installation. Even if the proposal is for considerably less than that, the project would result in cumulative impacts to on-post and off-post traffic, utilities, and demand for community services. Preliminary coordination with FCPS indicates that one or possibly two new elementary schools would be required for up to 998 housing units. If (or when) Dogue Creek Village is redeveloped, unless the housing units are rebuilt on the existing slabs, impacts to active and closed POL sites will require investigation and corrective action. Upon completion of corrective actions, a cumulatively beneficial effect to the environment will result over the long-term, with the removal from Fort Belvoir and/or treatment of POL-contaminated soil.

In addition to construction projects, recent changes in vehicular control at Fort Belvoir have the potential cumulative impacts with any other future activity. Following the 9/11 attack, all roads through the post other than the Fairfax County Parkway, US Route 1, and Backlick Road were closed to public access. Beulah Street at Telegraph Road was subsequently reopened to DoD-registered vehicles. Other changes being considered to ameliorate access problems include opening the Gunston Road overpass and Lieber Gate during peak traffic hours. Personnel from VDOT and Fairfax County are participating in a working group reviewing access control issues on Fort Belvoir's roads and at the gates. When long-term decisions on access are made, they will have an effect on the traffic patterns in and around the post.

4.14 Mitigation Summary

The ground lease is expected to require FBRC to accomplish mitigation measures that will reduce, avoid, or compensate for potentially-significant adverse effects. Army policy requires mitigation measures to be monitored. In addition, certain measures are proposed to further minimize adverse effects where mitigation is not required.

Table 4-39 summarizes the proposed minimization and mitigation measures to be taken for each of the affected resources.

TABLE 4-39
Summary of Mitigation Measures

Aesthetics and Visual Resources

Mitigation for on-post historic viewsheds will be addressed by the Section 106 consultation process. Mitigation for removal of historic and park trees is addressed under Vegetation.

The following measures will further minimize impacts:

- Maintain existing vegetation to screen the view of housing villages from outside the installation, along the boundaries of Lewis Heights Village with Woodlawn Plantation and of River Village

TABLE 4-39
Summary of Mitigation Measures

with Mount Vernon Memorial Highway.

- Develop a landscape planting and maintenance plan in coordination with DPW&L-ENRD that uses native plants and addresses invasive exotic vegetation management.
- Place new utility lines underground within the housing villages. Move those above-ground utility lines that are located on the perimeter of villages and that primarily serve the housing villages underground where practicable.
- Consult Fort Belvoir's Installation Design Guidelines for guidance in design of new structures and landscapes.
- Final design of elements including garages, street benches, street and yard lighting in the historic areas will be in accordance with the Section 106 consultation process.

Air Quality

Due to the phasing of construction activities, annual NOx emissions will be below *de minimis* levels established for the severe ozone non-attainment area. FBRC will document annual usage of NOx – emitting construction equipment throughout the IDP. FBRC will coordinate with DPW&L on tracking the equipment operating hours to remain below *de minimis* levels established for the severe ozone non-attainment area.

The following measures will further minimize impacts:

- FBRC will follow all applicable state regulations with regard to utilization of BACT in selecting and installing new heating unit appliances.
- FBRC will make every effort to further minimize construction equipment emissions.
- Air quality permit conditions provided in any permits obtained by FBRC will become incorporated into the CDMP and implemented
- Spray water on exposed soil, demolition debris and rock crushing debris to control fugitive dust.
- Implement soil erosion and sedimentation control to reduce dust.
- Restrict where vehicles can travel on-site.
- Implement speed controls for construction vehicles and equipment.

TABLE 4-39
Summary of Mitigation Measures

Noise

The following measures will minimize impacts:

- Limit noise-generating construction activities to daylight hours.
- Consult with the Post Industrial Hygienist and coordinate with representatives of sensitive receptors (such as the Chapel, Child Development Center and Hospital) regarding further protective measures if needed.

Geology and Soils

The following measures will minimize impacts:

- Minimize redevelopment of buildings and roads in areas with slopes of 15% or greater in currently developed areas.
- Maintain vegetated buffers in areas currently not developed between impervious areas and the top of slopes of 15 to 25% where practicable.
- Avoid development on slopes greater than 25% within currently undeveloped areas.
- Avoid development of roads and buildings on natural slopes between 15 and 25% (except for an eastern edge perimeter road in New South Post Village traversed in small increments where needed to provide proper connectivity for the residents). A road or a building may encroach on a slope of 15-25% in isolated areas in an increment of no more than 5,000 square feet.
- Use appropriate BMPs (such as silt fences, strawbale dikes, diversion ditches, rip-rap channels, water bars, and water spreaders) to reduce soil erosion and sedimentation.
- Explore the use of retaining walls to minimize grading

Water Resources

Floodplains

There are no significant impacts to the 100-year floodplains, therefore no mitigation is required.

Streams and Resource Protection Areas

- A field delineation of all Waters of the U.S. and a field assessment of stream perenniality will be conducted using the Fairfax County Perennial Stream Field Identification Protocols, in consulation with ENRD
- The site plan will be modified, where practicable, to avoid and minimize impacts to waters of the U.S., including intermittent and perennial stream channels.
- A mitigation plan will be developed, in consultation with the regulators, for any jurisdictional streams that are impacted.
- Mitigation may include restoration and enhancement of stream channels and upland buffers within the impacted subwatershed, and within the installation to the extent practicable, as required by the USACE and VA DEQ.
- Based on the field delineations and stream evaluations, the RPAs will be defined. The site plans will then be modified to ensure consistency with the Fairfax County Chesapeake Bay Preservation Ordinance and Environmental Qualtiy Corridor Policy.
- In addition to the protections provided to the 100-foot RPA buffer by the Fairfax County Chesapeake Bay Preservation Ordinance, vegetated buffers of up to 25 feet from top of bank around intermittent streams, ecologically significant ephemeral streams, and wetlands will be

TABLE 4-39
Summary of Mitigation Measures

maintained to the maximum extent practicable.

Stormwater

Mitigation for the increases in impervious surfaces will be provided through compliance with the Fairfax County Public Facilities Manual, as follows:

- Water quality BMPs (such as infiltration trenches, bioretention, amended soil, infiltration from underground stormwater management, structural BMPs, or retrofits to existing stormwater management facilities) will be provided to achieve all minimum standards in the Fairfax County Public Facilities Manual, to include a 40% reduction in phosphorus concentrations in stormwater runoff.
- Stormwater quantity controls will be provided in all areas where adequate outfall requirements are not met, as required by the Fairfax County PFM.
- Where practicable, infiltration-type stormwater management practices will be implemented, in an attempt to more closely mimic the hydrology of a vegetated site and reduce the impacts of concentrated flows.
- Special attention will be paid to provide the most effective BMPs in any watersheds where impervious surface is nearing the 25% threshold, which can lead to impaired streams. Stormwater runoff from New South Post Village will be specifically targeted for infiltration or additional retention, due to cumulative impacts in subwatershed 03.
- Erosion and sediment controls will be provided, as required in the Fairfax County PFM, to minimize excess erosion and sediment transport during construction. This will include reseeding and revegetating all disturbed areas following construction activities.
- Comply with all requirements of the VPDES General Permit for Construction, to include preparation, in coordination with ENRD, of a Storm Water Pollution Prevention Plan (SWPPP) for all construction activities.
- Comply with any requirements set forth in the Fort Belvoir Stormwater Management Master Plan, developed in compliance with the VPDES General Permit for Municipal Separate Storm Sewer Systems (MS4).

Discharge to Surface Waters

- If a concrete batch plant is utilized, all requirements of the VPDES General Permit for Industrial Facilities will be followed to minimize impacts of any discharge.

TABLE 4-39
Summary of Mitigation Measures

Biological Resources

Vegetation

In order to protect and avoid or minimize impacts to vegetation, the following measures will be taken:

- Conduct a survey for small whorled pogonia (*Isotria medeoloides*), which is federally listed as threatened and state-listed as endangered, in forested or wooded areas in each of the existing housing villages and the proposed new housing village. Avoid impacts to the plant, if identified within the housing footprint or immediately adjacent, by avoiding construction in the area surrounding the plant. Consult with USFWS and the VDCR (VDCR represents the Virginia Department of Agriculture and Consumer Services under an MOA) to discuss appropriate avoidance measures such as minimum protective radius for the plant.

- Conduct a tree survey (by qualified personnel) prior to construction. Assess the species, age, size, and health of each tree. Survey every park tree and tree stand location within the footprint of the existing housing villages and the proposed New South Post Village. Identify drip lines and canopy edges. Identify list of possible trees to save and/or relocate in concert with ENRD. Consider relocation for each new home, garage and road location for opportunities to reduce tree and viewshed impacts. Review impacts on a tree-by-tree and house-by-house basis, prior to completing the final construction site plans, in an attempt to reduce impacts to vegetative communities on Fort Belvoir.

- Limit disturbed areas to the planned housing footprint and a minimal amount of adjacent construction staging areas. Avoid clearing vegetation for construction staging to the extent practicable.

- Employ erosion control practices and tree protection devices at all proposed sites to protect vegetation and habitat areas.

- Preserve, to the extent practicable, the existing road networks in each village in an attempt to preserve existing vegetation such as street trees along the roadways.

In order to compensate for losses to vegetation including mature trees (after taking the above-mentioned actions to minimize losses), the following mitigation measures will be taken:

- Replace historic and park trees and trees that will be removed by construction on Fort Belvoir at a 1:1 ratio for every lost tree over 6 diameter at breast height. All replacement trees planted by FBRC must be approximately 2.5 inch caliper and nursery grown.

- Replant with native trees and shrubs near homes, along streets, in parks, in open spaces, and around the storm water management structures. Plant wet tolerant species in the appropriate storm water management structures such as vegetated swales.

Wildlife

In order to avoid or minimize these impacts, the following protective measures will be taken:

- Prohibit free roaming pets and remove feral cat colonies in order to prevent increased predation upon wild bird and small mammal populations.

- Impacts to wildlife through removal of trees will be compensated by tree replacement elsewhere on Fort Belvoir, as discussed under Vegetation.

Rare, Threatened, and Endangered Species

Potential impacts to rare, threatened, and endangered species are not significant. However, in order to avoid and/or minimize these impacts, the following protective measures will be taken:

- Prevent additional encroachment into bald eagle foraging areas and limit activities in these areas to passive recreational use.

TABLE 4-39
Summary of Mitigation Measures

- Provide proper stormwater management practices, minimize lawn chemical applications, and prohibit discharge of household chemicals into storm drains, in order to prevent potential impacts to downstream riparian wood turtle habitats from stormwater flow.
- Conduct a survey for small whorled pogonia (*Isotria medeoloides*), which is Federally and State-listed as threatened, in forested or wooded areas in each of the existing housing villages and the proposed New South Post Village. Avoid impacts to the plant if identified within the housing footprint or immediately adjacent, by avoiding construction in the area surrounding the plant. Consult with USFWS and the VDCR (VDCR represents the Virginia Department of Agriculture and Consumer Services under an MOA) to discuss appropriate avoidance measures, such as minimum protective radius for the plant.
- Distribute awareness and educational information developed by ENRD to residents and encourage residents to participate in natural resource awareness/training events hosted by ENRD.

Wetlands

Potential impacts to wetlands are not significant. However, in order to avoid and/or minimize these impacts, the following protective measures will be taken:

- Conduct a delineation of Wetlands and other Waters of the United States in each of the existing housing villages, the proposed housing village, and the two construction sites. Have the jurisdictional boundaries approved by the USACE. With a jurisdictional determination.
- Avoid all wetlands to the maximum extent practicable by reviewing site plans and relocating new homes, garages, and roads.

If avoidance is not practicable, the following mitigation measures will be taken:

- Obtain a Section 404 Permit from USACE and Virginia Water Protection Permit from VDEQ. Consult with the USACE and VDEQ regarding mitigation ratios and methods.
- Provide compensation through wetlands creation, enhancement and restoration with a preference for on-post, in-kind mitigation.
- Provide a functional assessment of the wetlands which will be impacted in order to also replace the functionality of these wetlands on Fort Belvoir.

TABLE 4-39
Summary of Mitigation Measures

Cultural Resources

No transfer of historic buildings, leasing of land containing historic resources, construction in the vicinity of historic resources or rehabilitation of historic buildings will occur until the requirements of Section 106 have been met.

Stipulations of the Programmatic Agreement, currently being developed in consultation with the VA SHPO and other consulting parties, will be incorporated into the ground lease. The public will be given adequate notification of the execution of the Programmatic Agreement.

Specific mitigation measures will be determined and implemented prior to commencement of work specifically affecting cultural resources.

Mitigation for the demolition of selected historic houses is expected to include:

- Maintaining two of the L-shaped houses in Park Village
- Performing Historic American Buildings Survey (HABS) documentation prior to removal or substantial alteration of buildings, in coordination with the Fort Belvoir Cultural Resources Manager
- Preparing an Internet-ready, multi-media presentation on the history of Army family housing at Fort Belvoir, in coordination with the Fort Belvoir Cultural Resources Manager.
- Explore the feasibility of deconstructing historic properties that will be removed to facilitate the salvage of reusable components

Mitigation for potential impacts to archeological sites is expected to include:

- Completing archeological surveys to determine the NRHP eligibility of known potentially-eligible resources in the area of potential effect and consultation to determine how to avoid or resolve adverse effects on NRHP-eligible properties that will be affected.
- Including clauses in construction contracts requiring that, if archeological artifacts are unearthed during construction, construction activities in the immediate area will immediately stop. The Fort Belvoir Cultural Resources Manager will be notified and FBRC will make every reasonable effort to ensure that no unauthorized personnel have access to the site and that no further damage is done to the discovery, until Fort Belvoir has complied with 36 CFR 800.13(b) and any other legal requirements.

Socioeconomics and Protection of Children

Potential impacts are not significant and mitigation is not required. The following measures will minimize impacts:

- Environmental justice: Implement measures as necessary to minimize construction traffic, noise and fugitive dust that might affect nearby neighborhoods.
- Protection of Children: Secure construction vehicles and equipment when not in use. Place barriers and "No Trespassing" signs around construction sites where practicable. Avoid the use of building products containing hazardous materials.

TABLE 4-39
Summary of Mitigation Measures

Traffic and Transportation

Potential impacts to traffic are not significant and mitigation is not required. However, in order to minimize impacts, the following measures will be taken:

- Work with the garrison and tenants to address incremental contributions of traffic from this project to existing and future traffic problems.
- Advocate mass transit opportunities by constructing on-post bus shelters and providing links to transit agency websites that provide bus, Metro and carpooling information.
- Establish temporary parking to replace Hospital parking spaces lost to the extension of 12th Street and Dental Clinic overflow parking. Replace South Post Golf Course parking spaces.

Utilities

Potential impacts to utilities are not significant and mitigation is not required. The following measures will minimize impacts:

Potable Water: Capacity serving the existing villages, New South Post Village (including the neighborhood centers, Welcome Center and Recreation Center) is adequate. Potential effects on drinking water quality, pressure, and flow will be evaluated in final engineering. Water-efficient control devices such as low-flow showerheads, faucets, and toilets will be installed in all new facilities.

Wastewater: Capacity serving the existing villages and New South Post Village is adequate. However, a new wastewater pump station onsite and (pending final engineering) an upgraded offsite wastewater pump station is expected to be needed to serve a portion of New South Post Village.

Energy: Consumption is not expected to increase. Capacity serving New South Post Village will be evaluated in final engineering. All new appliances in new and rehabilitated housing units will meet Energy Star energy efficiency standards. Ranges, ovens, water heaters and furnaces installed in new and rehabilitated housing units will use natural gas.

Solid Waste: Explore opportunities to salvage, reuse and recycle demolition materials, including donation of usable appliances to charitable organizations. The proposed stone crusher will recycle brick, stone and concrete as road materials.

Recycling: FBRC will participate in Fort Belvoir's mandatory recycling program in accordance with federal, state and local policies and regulations and will provide information on recyclable items, by weight or by volume removed, to DPW&L on a monthly or quarterly basis.

Hazardous and Toxic Substances

No mitigation is necessary, because compliance with the law will protect the environment. However, the following measures will utilized to minimize impacts:

- Perform sampling, classification and disposal of demolition material in accordance with applicable regulations (VDEQ) and the standards of the appropriate, licensed off-post receiving facility, at the time of demolition and rehabilitation activities.
- Comply with USEPA/ HUD guidelines regarding lead in surface soil, in locations that exceeded the 400 ppm USEPA/ HUD guideline in 1995 and 1997 LBP assessments.
- Avoid disturbing closed petroleum contamination sites where practicable.
- Sample areas where petroleum contamination is known or suspected to exist for appropriate parameters prior to ground disturbance. As applicable, a corrective action plan will be filed with VDEQ.

TABLE 4-39
Summary of Mitigation Measures

- Coordinate construction near active and closed corrective action sites with ENRD.
- Control LBP and ACM during demolition to avoid the potential to contaminate the environment. Construction, demolition, renovation and maintenance work that could affect LBP and ACM will be conducted by licensed and qualified personnel.
- Implement Army-approved Spill Plan to prevent releases.
- Conduct sampling for radon where necessary. As needed, new construction in areas susceptible to radon will include an engineered control (such as subfloor venting or barriers) to minimize or eliminate radon accumulation.

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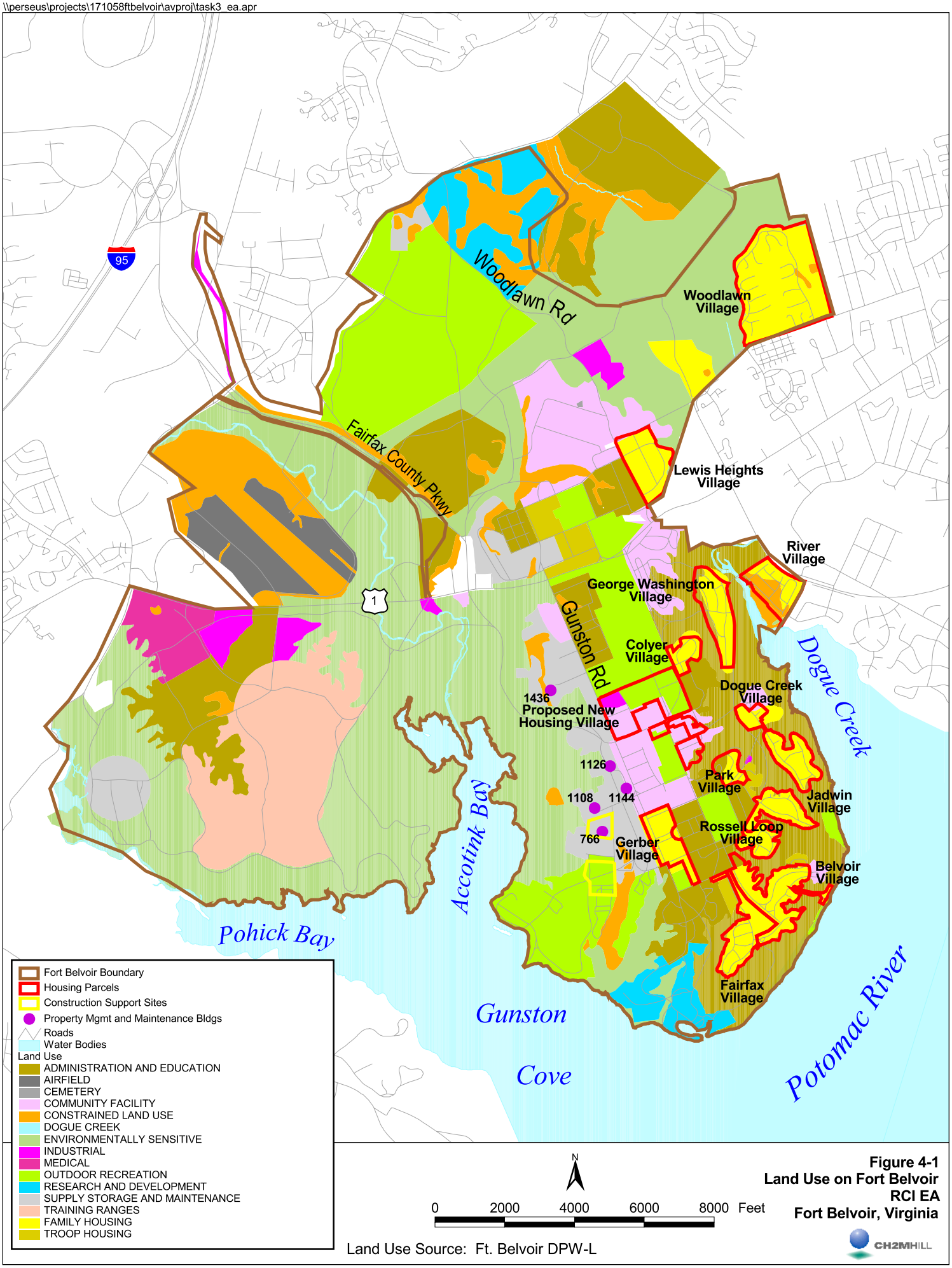

Land Use Source: Ft. Belvoir DPW-L

Figure 4-1
Land Use on Fort Belvoir
RCI EA
Fort Belvoir, Virginia

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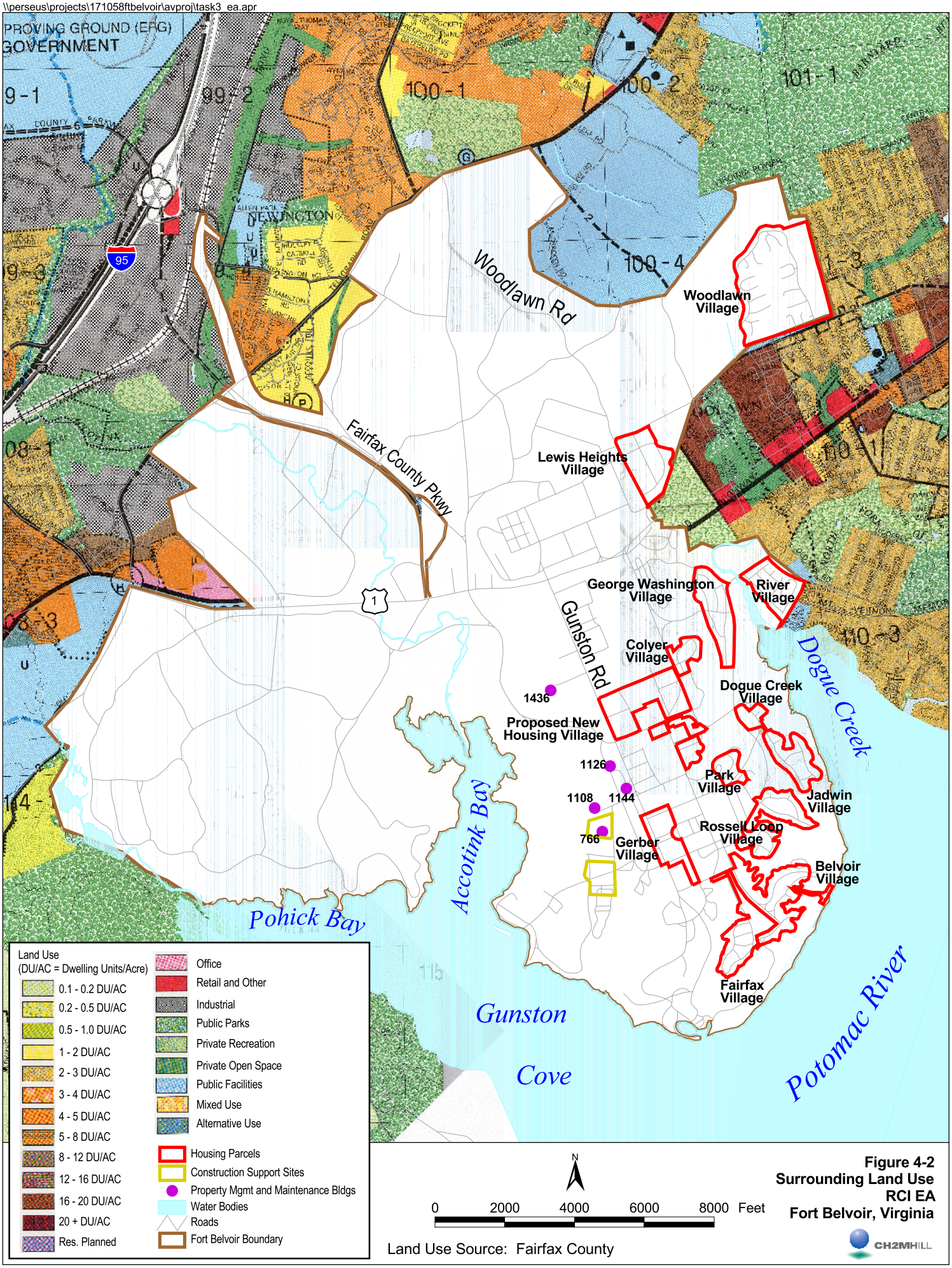

Figure 4-2
Surrounding Land Use
RCI EA
Fort Belvoir, Virginia

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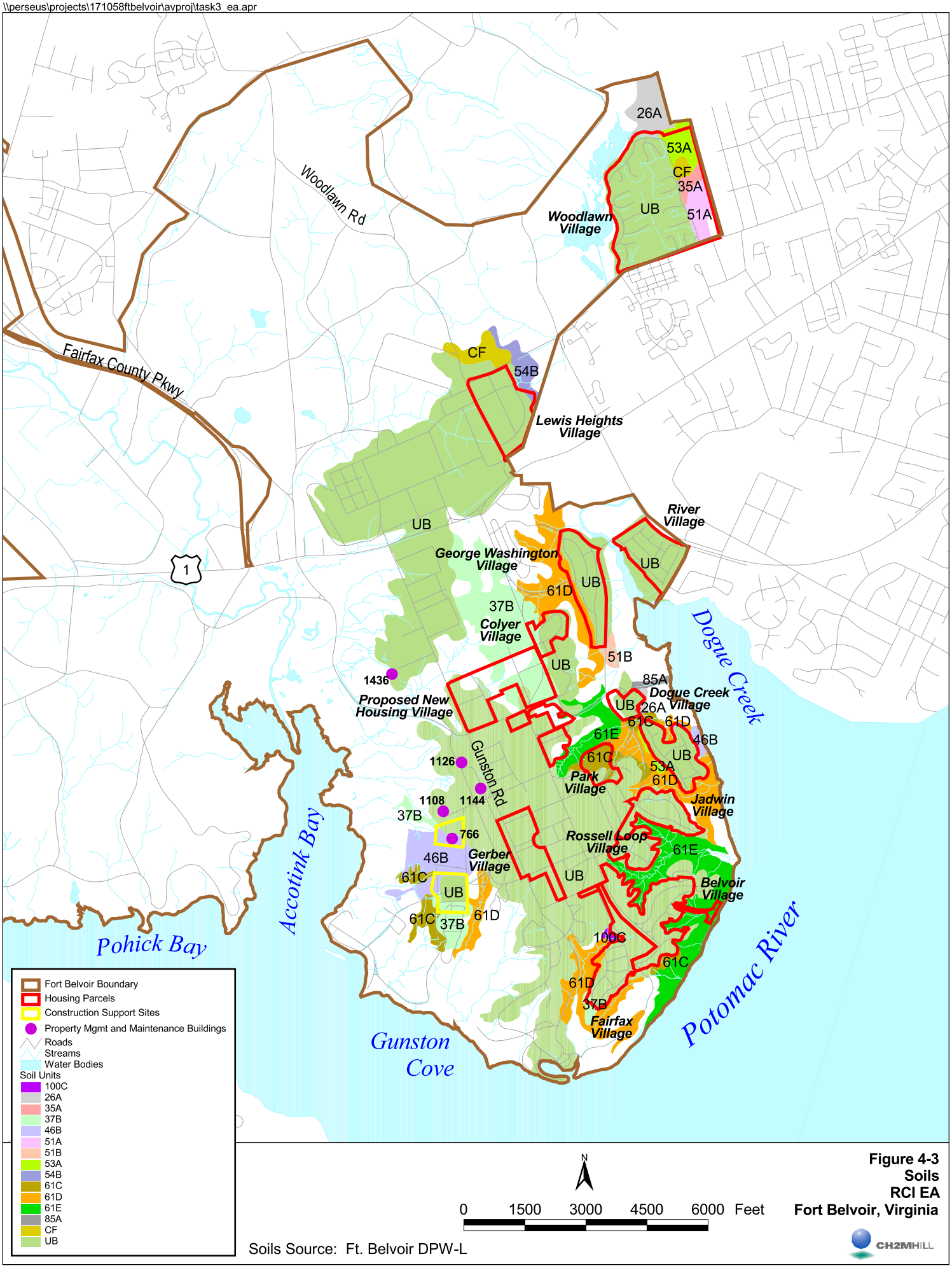
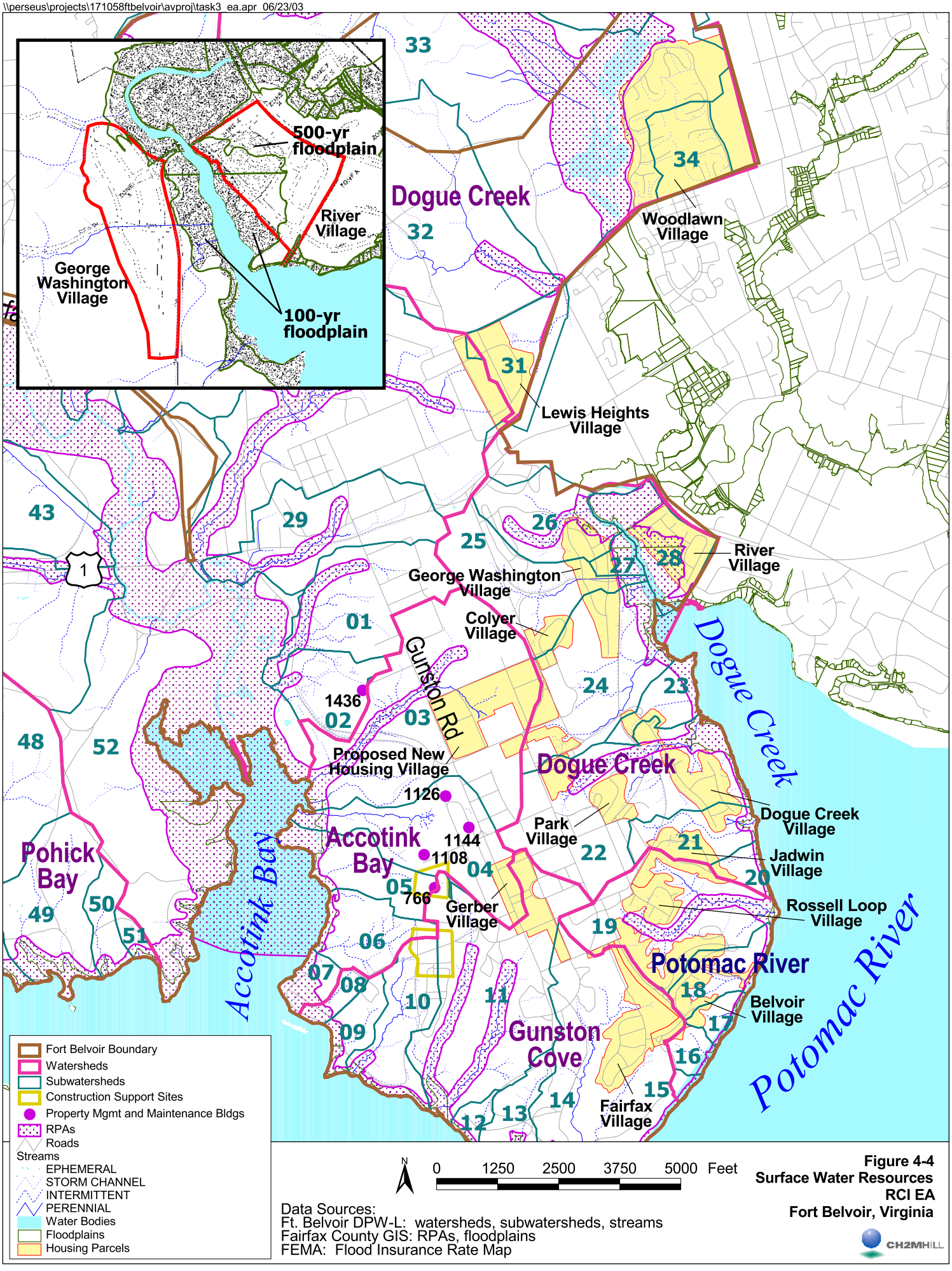


Figure 4-3
Soils
RCI EA
Fort Belvoir, Virginia



Data Sources:
Ft. Belvoir DPW-L: watersheds, subwatersheds, streams
Fairfax County GIS: RPAs, floodplains
FEMA: Flood Insurance Rate Map

Figure 4-4
Surface Water Resources
RCI EA
Fort Belvoir, Virginia

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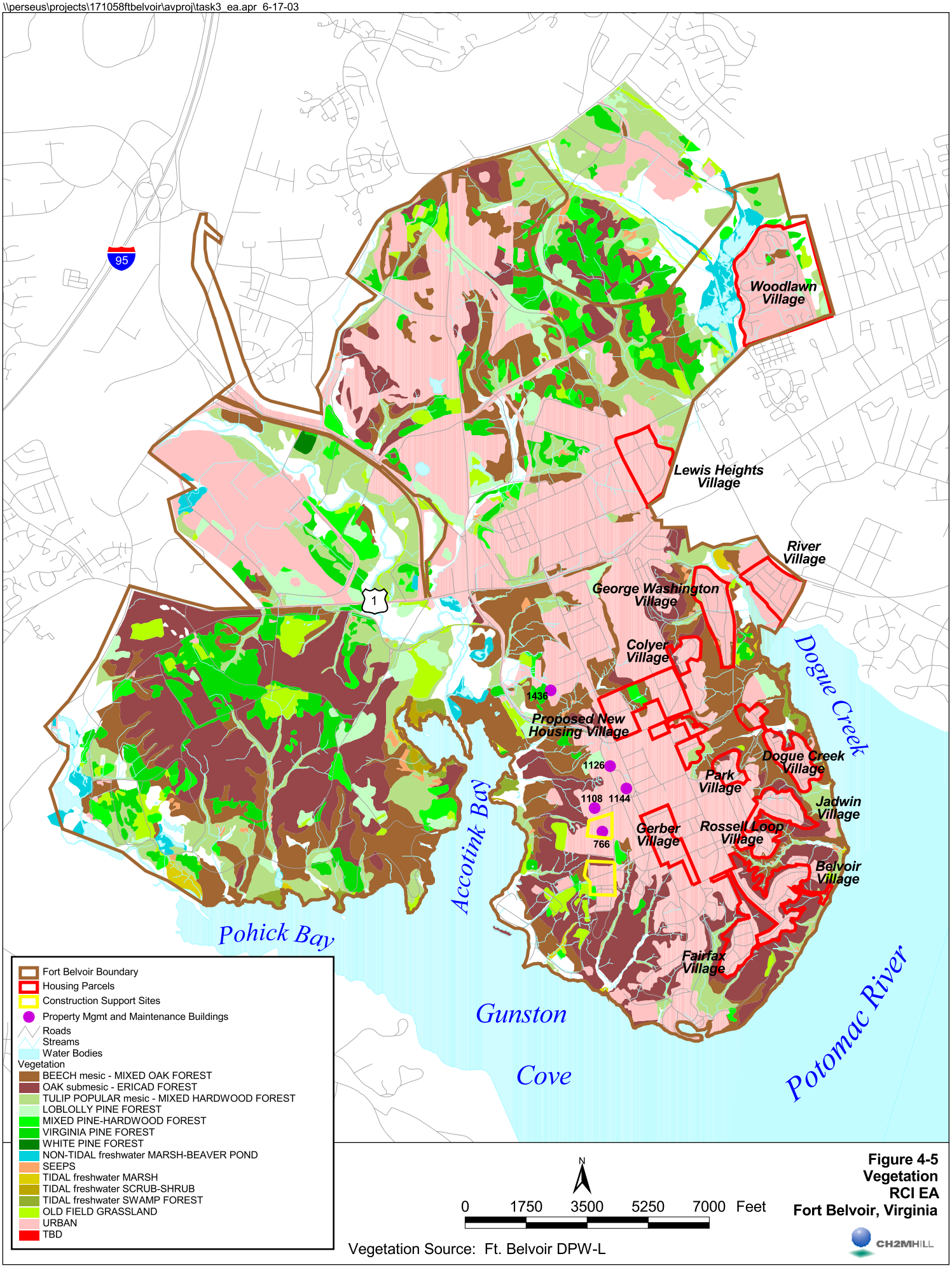

Figure 4-5
Vegetation
RCI EA
Fort Belvoir, Virginia

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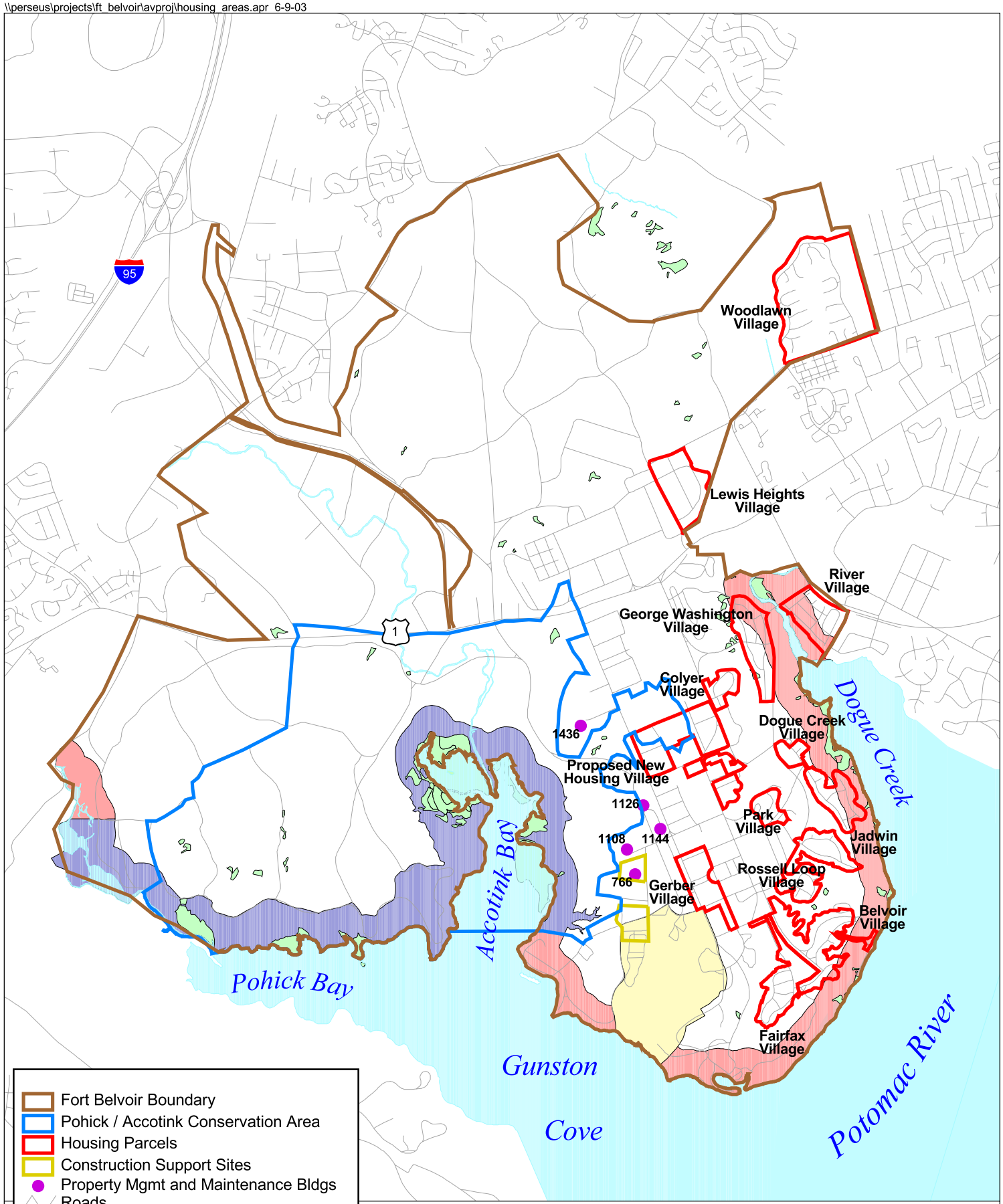

Figure 4-6
Rare, Threatened, and Endangered Species
Fort Belvoir, Virginia

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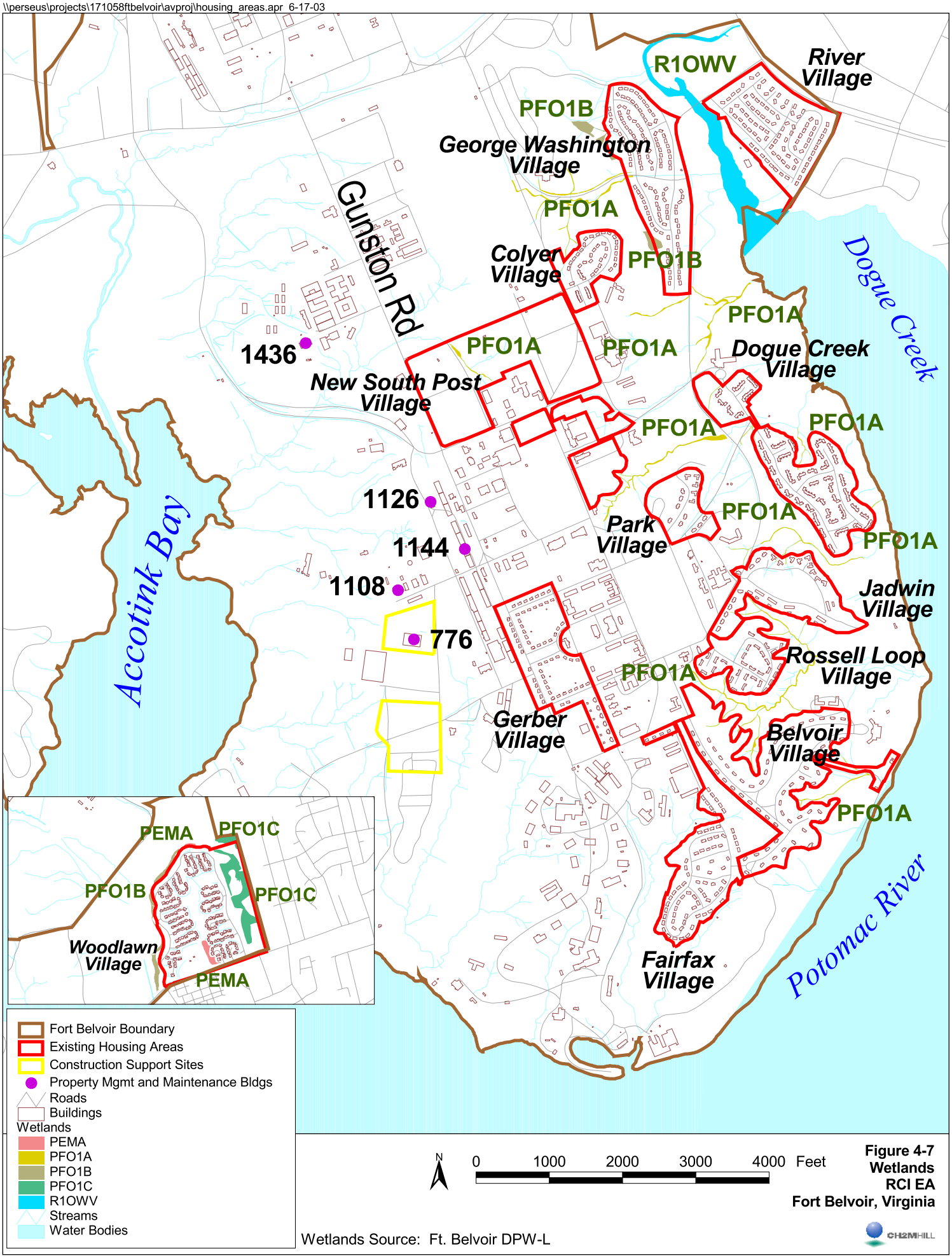

Figure 4-7
Wetlands
RCI EA
Fort Belvoir, Virginia

Wetlands Source: Ft. Belvoir DPW-L

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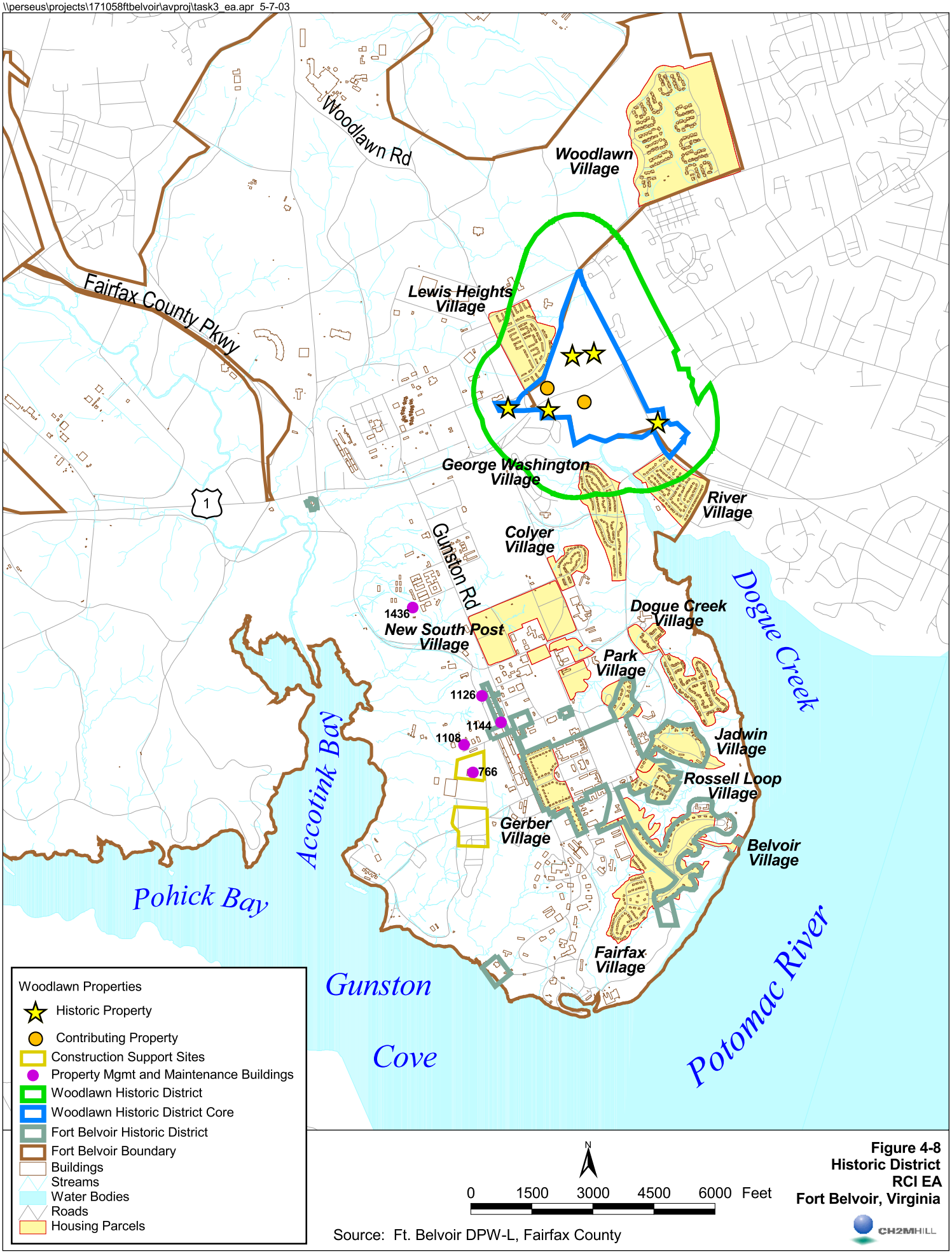

Source: Ft. Belvoir DPW-L, Fairfax County

Figure 4-8
Historic District
RCI EA
Fort Belvoir, Virginia

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95
Fairfax County Pkwy
1
Woodlawn Rd
Beulah St
Kingman Rd
Meeres Rd
Abbott Rd
Goethals Rd
Gunston Rd
Belvoir Rd
Mt. Vernon Rd
Pohick Rd
12th St
18th St
235
Woodlawn Village
Lewis Heights Village
George Washington Village
River Village
Colyer Village
Dogue Creek Village
New South Post Village
Park Village
Jadwin Village
Rossell Loop Village
Gerber Village
Belvoir Village
Fairfax Village
1436
1126
1144
1108
776
Accotink Bay
Pohick Bay
Gunston Cove
Dogue Creek
Potomac River

Study Area Intersections
Fort Belvoir Boundary
Property Mgmt and Maintenance Bldgs
Roads
Buildings
Streams
Water Bodies
Proposed New Housing Areas
Construction Support Sites

N

0 2500 5000 7500 10000 Feet

Source: Ft. Belvoir DPW-L

Figure 4-9
Study Area Intersections
RCI EA
Fort Belvoir, Virginia

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5 Findings and Conclusions

The evaluation of the proposed action, identified as the Army's preferred alternative, indicates that the physical and socioeconomic environments at Fort Belvoir and in the ROI would not be significantly affected with the mitigation measures identified in Section 4.14. The predicted consequences on resource areas are briefly described below. Table 5-1 provides a summary and comparison of the consequences of the proposed action versus the no action alternative, which are discussed in detail in Section 4.0.

For the purposes of this EA, "short-term" refers primarily to construction-related impacts, which will cease when construction ends. However, it is acknowledged that these impacts will occur, in different areas of the post, for up to 8 years, which is not a short period of time." Long-term" refers to the effects of ongoing housing operations, to permanent impacts that will result from lease, transfer or construction, and to impacts that will take many more years to recover from.

5.1 Findings

The evaluation of the proposed action, identified as the Army's preferred alternative, indicates that the physical and socioeconomic environments at Fort Belvoir and in the ROI would not be significantly affected. The predicted consequences on resource areas are briefly described below. Table 5-1 provides a summary and comparison of the consequences of the proposed action versus the no action alternative.

5.1.1 Consequences of the Proposed Action

5.1.1.1 Land Use

Overall, the proposed action would result in long-term minor beneficial effects on installation land use. Locating the New South Post Village closer to community services is an improvement in land use. Existing residential areas would be improved for the designated land use through housing revitalization and reconditioning. The proposed action would increase acreage currently designated Family Housing land use and reduce the existing acreage designated for Administrative/Educational and Community Facilities land use categories.

5.1.1.2 Aesthetics and Visual Resources

Short-term minor adverse effects would be expected due to the loss of some mature trees in the existing villages and in the New South Post Village. However, all trees will be replaced on Fort Belvoir. Long-term minor beneficial effects would be expected as a result of rehabilitating existing housing units that are currently in need of upgrading; constructing new, modern housing; and adding recreational areas and native-plant landscaping.

TABLE 5-1
Summary of Potential Environmental and Socioeconomic Consequences

Resource	Environmental and Socioeconomic Consequences	
	Proposed Action	**No Action Alternative**
Land Use	Long-term minor beneficial	No effects
Aesthetic and Visual	Long-term minor beneficial	No effects
Air Quality	Adverse effects over the 8-year construction period; not significant as emissions are less than *de minimis*.	No effects
Noise	Short-term minor adverse	No effects
Geology and Soils		
• Geology	No effects	No effects
• Topography	No effects	No effects
• Soils	Short-term minor adverse Long-term minor beneficial	Long-term minor adverse
• Prime Farmland	No effects	No effects
• Seismicity	No effects	No effects
Water Resources		
• Surface Water	Short-term minor adverse Long-term beneficial	Long-term minor adverse
• Groundwater	Long-term minor beneficial	No effects
• Floodplains	Long-term minor beneficial	Long-term minor adverse
Biological Resources		
• Vegetation and Wildlife	Short-term minor adverse	No effects
• Rare, Threatened, and Endangered Species	Short-term minor adverse (from noise) No long-term effects	No effects
• Wetlands	Short-term minor adverse	No effects
• Coastal Zone Management	No effects	No effects
Cultural Resources	Long-term adverse	No effects
Socioeconomics		
• Economic Development	Short-term and long-term minor beneficial	No effects
• Demographics	Minor increase in population	No effects
• Housing	Long-term beneficial	No effects

TABLE 5-1
Summary of Potential Environmental and Socioeconomic Consequences

Resource	Environmental and Socioeconomic Consequences	
	Proposed Action	**No Action Alternative**
• Quality of Life	Long-term beneficial for housing and recreation Possible minor adverse for school	No effects
• Public Health and Safety	No appreciable effects	No effects
• Environmental Justice	Short-term minor adverse	No effects
• Protection of children	Short-term minor adverse Long-term minor beneficial	No effects
Transportation		
• Roadways and Traffic	Long-term minor adverse	No effects
• Public Transportation	No effects	No effects
Utilities		
• Potable Water	Long-term minor beneficial Possible short-term adverse impacts as construction is ongoing until final reductions are achieved	No effects
• Sanitary Sewer	Long-term minor beneficial Possible short-term adverse impacts as construction is ongoing until final reductions are achieved	No effects
• Energy (Electricity and Gas)	Long-term minor beneficial	No effects
• Communications	Long-term minor beneficial	No effects
• Solid Waste	Short-term minor adverse	No effects
Hazardous and Toxic substances	Long-term minor beneficial	Long-term minor adverse

5.1.1.3 Air Quality

Adverse effects would be associated with demolition, rehabilitation, and construction activities and their accompanying generation of fugitive dust and vehicle air emissions over the 8-year construction period. These impacts are not considered significant as the emissions are below the *de minimis* level with the annual phasing of construction.

5.1.1.4 Noise

Short-term minor adverse effects of noise in the annoyance range (70 decibels and above) for residents and wildlife would be expected during construction and rehabilitation activities.

5.1.1.5 Geology and Soils

No effects to geology, topography, prime farmland, or seismic activity would be expected from the proposed action.

Both short-term minor adverse effects and long-term minor beneficial effects to soils would be expected in those areas within the villages where demolition of existing houses and new construction are expected. In the long term, implementation of the proposed action would decrease soil erosion from storm water runoff through the creation of storm water BMPs.

5.1.1.6 Water Resources

Both long-term beneficial and short-term minor adverse effects would be expected for surface water as a result of storm water management during the construction of new housing villages. Long-term minor beneficial effects would be expected on groundwater because of storm water management measures envisioned that will promote infiltration. Long-term beneficial effects would be expected on surface waters, because water quality and quantity treatment will be provided where there are currently none. Short-term adverse effects would be expected due to deteriorated water quality during construction. Erosion control measures will be provided to limit thi s impact, however some minor impacts to water quality will be expected.

5.1.1.7 Biological Resources

Construction activities and associated clearing will cause temporary short-term adverse effects to the vegetation and wildlife. However, all trees lost to clearing (greater than 6 dbh) will be replaced on Fort Belvoir in coordination with ENRD. Wildlife will avoid the areas in the housing villages while construction activities are underway, however, it is expected some will return once construction is complete. Short-term adverse effects may be expected to wildlife and sensitive species due to noise. No long-term adverse effects are expected for sensitive species.

Wetlands impacted during construction are expected to be minor due to maintaining the forested buffers associated with streams that contain the majority of the wetland systems. Long-term effects are not expected because construction activities will seek to avoid impacts to wetlands and all impacts will be mitigated with compensation in the form of creation, restoration, or enhancement.

5.1.1.8 Cultural Resources

Long-term adverse effects will result from the transfer of historic buildings to FBRC, demolition and rehabilitation of historic housing, and construction that may impact archeological sites. However, the undertaking is not expected to result in significant impacts, because adverse effects on historic properties will be mitigated in accordance with the Programmatic Agreement that is being developed by the Army in consultation with the Virginia SHPO and other consulting parties.

5.1.1.9 Socioeconomics

Short-term minor beneficial effects to the regional economy and long-term beneficial effects to quality of life would be expected. A minor increase in population could result in some increased demand for services, but is not expected to have an appreciably adverse effect.

Short-term adverse effects of construction on off-post minority population from noise, dust, and traffic generated by construction will be minimized through construction plans and controls.

5.1.1.10 Transportation

As a result of the proposed action to rehabilitate and replace units in existing housing villages, there will be increases in traffic on roadways on and surrounding Fort Belvoir. The overall impact of this added traffic is not considered significant. Many study area intersections are expected to be at or to exceed their theoretical capacity, with or without the proposed action , beyond those that are expected to do so without the proposed action. Additional trips generated by the RCI development do not result in any intersections within the study area exceeding their theoretical capacity, beyond those that are expected to do so without the proposed improvements. Planned projects by others for roadways surrounding Fort Belvoir have the potential to reduce congestion on roadways serving the area.

5.1.1.11 Utilities

Long-term minor beneficial effects would be expected as a result of providing new delivery lines for potable water supply and new wastewater collection lines, upgrading electric service, and installing communication lines underground in all new areas of construction. Long-term beneficial effects would result from the new construction and rehabilitation of existing housing units with the installation of energy efficient materials and systems. Short-term adverse (but not significant) effects would be expected from the debris associated with the construction, demolition, and rehabilitation of family housing units and initial increases in water and sewer demand until final reductions in usage are achieved after construction is complete. Water consumption for the construction activities is not expected to adversely affect the water system.

5.1.1.12 Hazardous and Toxic Substances

Overall, long-term minor beneficial effects would be expected with the removal and proper disposal of all hazardous materials brought in (i.e., for construction activities) or existing on the property. The long-term beneficial effects will be realized as FBRC coordinates with the Army to minimize disturbance or impacts affecting the current status of SWMU sites, closed POL sites, and on-going remedial activities on the RCI properties as well as the adjacent properties.

5.1.1.13 Cumulative Effects

Long-term adverse cumulative effects are expected in traffic and air quality and biological resources. For air quality, development projects such as DCEETA, DAAF FS, INSCOM HOT, DTRA, DeWitt Hospital, AMC and other planned construction projects, combined with the proposed action, will most likely result in post-wide NOx net emission increases above the NSR threshold of 25 tpy. Therefore, it is probable that future new stationary sources to the post may be subject to nonattainment NSR requirements because of the potential post-wide NOx net increase.

Long-term beneficial cumulative effects are expected in storm water management with the mitigation measures described. Increased impervious surface from RCI, AMC, DeWitt Hospital and New North Post Chapel will result in an increased volume of stormwater

runoff, however the proposed stormwater management for each facility is anticipated to provide sufficient mitigation to prevent cumulative adverse impacts. Potential impacts to vegetation, wildlife, and wetlands from the RCI project are not expected to significantly increase overall effects from the relocation of DeWitt Hospital, DTRA and AMC headquarters and the construction of the New North Post Chapel.

5.1.2 Mitigation

Mitigation actions would be expected to reduce, avoid, or compensate for most adverse effects. Refer to Table 4-34 in Section 4.14 for a summary of proposed mitigation measures.

5.1.3 Consequences of the No Action Alternative

Only those resources that would be affected by the no action alternative are discussed below.

5.1.3.1 Aesthetic and Visual Resources

Long-term minor adverse effects would be associated with deterioration of on-post housing over time and from the continuation of existing conditions such as overhead utility lines and visibility of Lewis Heights housing from Woodlawn Plantation.

5.1.3.2 Water Resources

Long-term minor adverse effects on streams are expected, due to the lack of storm water management in many of the existing housing villages under existing conditions, because streams will continue to erode and adjust, creating steep and undercut stream banks, until a new, stable channel alignment is reached.

5.1.3.3 Socioeconomics

Long-term minor adverse effects would be associated with deterioration of on-post housing over time.

5.1.3.4 Hazardous and Toxic Substances

Minor adverse effects could be associated with housing units that contain special hazards such as LBP and tiles made with ACM. Fort Belvoir would continue to manage and abate these potential hazards in accordance with all applicable laws, but abatement could be over a greater period of time than the period under the proposed action, and therefore the possibility of adverse effects must be recognized. However, no additional adverse effects beyond those currently present for the actual and suspected hazardous or POL materials in the RCI footprint would occur if construction of rehabilitation activities did not occur.

5.1.3.5 Geology and Soils

Construction activities related to normal maintenance and repair of housing units would result in some disturbance to soils. Short -term minor adverse effects from erosion are possible, due to the lack of storm water management facilities in many of the existing housing villages under existing conditions.

5.1.3.6 Cumulative Effects

The no action alternative would not be expected to result in any cumulative effects.

5.2 Conclusions

Implementation of the preferred alternative, coupled with coupled the mitigation measures identified in Section 4-14, will result in no significant, long-term effects on the quality of the natural or human environment. An Environmental Impact Statement is not required and will not be prepared. Issuance of a Finding of No Significant Impact is appropriate.

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10 Acronyms and Abbreviations

µg/m^3	micrograms per cubic meter
°F	degrees Fahrenheit
AAFES	Army and Air Force Exchange Service
ACBM	Asbestos-Containing Building Materials
ACHP	Advisory Council on Historic Preservation
ACM	asbestos-containing material
AEC	Army Environmental Center
AMC	Army Material Command
APE	Area of Potential Effect
AR	Army Regulation
ARB	(Fairfax County) Architectural Review Board
AST	aboveground storage tank
ATM	Asynchronous Transfer Mode
BACT	best available control technologies
BFE	Base Flood Elevation
BMP	best management practice
BOCA	Building Officials and Code Administrators International, Inc.
CAA	Clean Air Act
CAP	Corrective Action Plan
CBLAD	Chesapeake Bay Local Assistance Department
CDMP	Community Development and Management Plan
CEETA	Communications Electronics Evaluation and Testing Activity
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
cm	centimeter
CO	carbon monoxide
CRB	Clark Realty Builder

CRMP	Coastal Resources Management Program
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
DA	Department of the Army
DA PAM	Department of the Army Pamphlet
dBA	decibel A-rated
DC	District of Columbia
DIS	Directorate of Installation Support (now DPW&L)
DIS-ENRD	Directorate of Installation Support, Environmental and Natural Resource Division (now DPW&L-ENRD)
DoD	Department of Defense
DOI	Department of the Interior
DPW&L	Directorate of Public Works and Logistics (formerly DIS)
DPW&L-ENRD	Directorate of Public Works and Logistics, Environmental and Natural Resource Division (formerly DIS-ENRD)
DVP	Dominion Virginia Power
EA	Environmental Assessment
EBS	Environmental Baseline Survey
EIFS	Economic Impact Forecast System
EIS	Environmental Impact Statement
EJ	Environmental Justice
EMS	emergency medical service
EMT	emergency medical technician
EO	Executive Order
EPG	Engineer Proving Ground
EQCC	Environmental Quality Control Committee (Fort Belvoir)
ESA	Endangered Species Act
FBFCU	Fort Belvoir Credit Union
FBRC	Fort Belvoir Residential Communities
FCPS	Fairfax County Public Schools
FCWA	Fairfax County Water Authority
FEMA	Federal Emergency Management Agency
FFPA	Farmland Protection Policy Act

FONSI	Finding of No Significant Impact
ft^3	cubic feet
gal.	gallon
GIS	geographical information system
GPS	global positioning system
ha	hectare
HABS	Historic American Buildings Survey
HAP	hazardous air pollutants
HUD	U.S. Department of Housing and Urban Development
HVAC	heating and air conditioning systems
ICRMP	Integrated Cultural Resources Management Plan
INRMP	Integrated Natural Resources Management Plan
IPM	Integrated Pest Management
ISDN	Integrated Services Digital Network
ITE	Institute of Transportation Engineers
ITR	information, ticketing, and registration
JMAWR	Jackson Miles Abbott Wetland Refuge
JNCO	Junior Non-Commissioned Officer
JENL	Junior Enlisted
kgal	1,000 gal
KV	kilovolt
KWh	kilowatt-hours
LAER	lowest achievable emission rate
LBP	lead-based paint
L_{dn}	day-night level
LPH	liquid petroleum hydrocarbons
MD	Maryland
MDW	Military District of Washington
MG	million gallons
mgd	million gallons per day
MHPI	Military Housing Privatization Initiative
mph	miles per hour

MS4	Municipal Separate Storm Sewer System
MSA	Metropolitan Statistical Area
MSL	mean sea level
msl	mean sea level
MWAQC	Metropolitan Washington Air Quality Committee
MWCOG	Metropolitan Washington Council of Governments
NAA	Nonattainment Area
NAAQS	National Ambient Air Quality Standards
National Register	National Register of Historic Places
NAVD88	North American Vertical Datum of 1988
NEPA	National Environmental Policy Act of 1969
NESHAP	National Emission Standards for Hazardous Air Pollutants
NFA	No Further Action
NGVD29	National Geodetic Vertical Datum of 1929
NHPA	National Historic Preservation Act of 1966
NOI	Notice of Intent
NOx	nitrogen oxide
NOx	nitrogen dioxide
NRCS	National Resources Conservation Service
NRHP	National Register of Historic Places
NRHP	National Register of Historic Places
NSPS	New Source Performance Standards
NSR	New Source Review
NWR	National Wildlife Refuge
O&M	Operation and Maintenance
O_3	ozone
OMB	Office of Management and Budgets
OSHA	Occupational Safety and Health Administration
P2SP	Phase II Storm Water Program
PA	Programmatic Agreement
Pb	lead
PCB	polychlorinated biphenyl

pCi/L	pico-Curies per liter
PEMA	palustrine emergent temporarily flooded
PFO1A	palustrine forested deciduous temporarily flooded (wetlands)
PFO1B	palustrine forested deciduous saturated (wetlands)
PFO1C	palustrine forested deciduous seasonally flooded (wetlands)
PL	Public Law
PM	particulate matter
PMSA	Primary Metropolitan Statistical Area
ppm	parts per million
PSD	Prevention of Significant Deterioration
QDM	Quality Deer Management
RCI	Residential Communities Initiative
RCRA	Resource Conservation and Recovery Act
RFQ	Request for Qualifications solicitation
RMA	resource management area
ROD	Record of Decision
ROI	region of influence
RONA	Record of Non-Applicability to the General Conformity Rule
RPA	resource protection area
RTV	Rational Threshold Value
SCR	Site Characterization Report
SCS	Soil Conservation Service
SHPO	State Historic Preservation Officer
SIP	State Implementation Plan
SNCO	Senior Non-Commissioned Officers
SO_2	sulfur dioxide
SWMU	Solid Waste Management Units
SWPPP	Storm Water Pollution Prevention Plans
THPO	Tribal Historic Preservation Officer
tpd	tons per day
tpy	tons per year
TSCA	Toxic Substances Control Act

U.S.C.	United States Code
UB	urban built-up
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
UST	underground storage tanks
v/c	volume to capacity
VA	Virginia
VAC	Virginia Administrative Code
VDEQ	Virginia Department of Environmental Quality
VDCR	Virginia Department of Conservation and Recreation
VDCR/DNH	Virginia Department of Conservation and Recreation, Division of Natural Heritage
VDGIF	Virginia Department of Game and Inland Fisheries
VDGIF	Virginia Department of Game and Inland Fisheries
VDOT	Virginia Department of Transportation
VOC	volatile organic compound
VPDES	Virginia Pollutant Discharge Elimination System
VRE	Virginia Railway Express
WMATA	Washington Metropolitan Area Transportation Authority
WWI	World War I
WWII	World War II

Appendix A
CDMP Development Brief

CLARK PINNACLE
FAMILY COMMUNITIES LLC

EA Development Brief

CDMP
FORT BELVOIR

July 7, 2003

Draft

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Note: this document is representative of the current scope for the RCI Development. As the CDMP is further developed, the details of this document may change within the development as described within the Environmental Assessment.

1.0 PROJECT OVERVIEW

1.1 The RCI Program

In February 1996, President Clinton signed into law the Defense Authorization bill, now Public Law 104-106. As codified on 10 U.S.C. 2871 et seq. are provisions collectively known as the Military Housing Privatization Initiative, which provides the Services with alternative authorities for construction and improvement of military housing (family and unaccompanied personnel). Under these authorities, the Services can leverage appropriated housing construction funds and government-owned assets to attract private capital in an effort to improve the quality of life for our soldiers and their families. This legislation provides a way to maximize use of limited appropriated funds, land, and existing facilities to encourage private sector investment.

Under the Residential Communities Initiative (RCI), the Army will establish long-term business relationships with private sector developers for the purpose of improving military family housing communities. The Army will provide the developer a long-term interest in both land and family-housing assets. These developers will become the master community developers for the Army community. The primary source of financial return for the developers will be the revenue stream generated from the military personnel's basic allowance for housing, which will be paid as rent.

1.2 The Project

The RCI program, as it is being undertaken at Fort Belvoir, will include the provision of new housing units and the rehabilitation of existing housing units with the ongoing maintenance and management of both. In undertaking this process the demolition of select existing units will need to be undertaken.

It is the objective of Fort Belvoir Residential Communities (FBRC) to enhance and restructure the existing housing areas into functional, livable communities. This will include the creation of community facilities and addition of infrastructure to improve the greater community.

As part of the project, FBRC will develop an Out-Year Development Plan (ODP) for ongoing revitalization through construction of additional amenities and systematic renovation of existing structures.

1.3 RCI Program Goal and Objectives

The goal of the RCI program is to eliminate inadequate Army family housing at installations across the United States.

The objectives of the RCI program include:

- Creating quality residential communities
- Leveraging assets / scarce funds
- Obtaining private sector expertise, creativity, innovation and capital

2.0 PRINCIPLES AND GUIDELINES

2.1 Site Descriptions

Fort Belvoir is located along the Potomac River on 8,656 acres of land. It is approximately 10 miles from the Pentagon. The southern portion of the post is bounded on the east, south and west by the Potomac River. Fort Belvoir is accessible via Route 1, George Washington Memorial Parkway, Mount Vernon Memorial Parkway, Telegraph Road, Beulah Street and Backlick Road. These roads bring traffic from I-95 or the I-495 Beltway into the Fort Belvoir installation.

Fort Belvoir is one over 20 military installations managed and funded within the Northeast Region Office (NERO) of the Installation Management Agency (IMA). Army personnel stationed throughout the Washington, D.C. area live at Fort Belvoir and work in the Pentagon, at Fort Myer, Fort McNair and in various Federal government offices as well as in the organizations located at Fort Belvoir. The Post's present mission is to provide essential administrative and basic operations support to its tenant organizations.

Fort Belvoir is home to several major Army command headquarters and elements of others: 19 different agencies of the Department of Army, eight elements of the U.S. Army Reserve and the Army National Guard; and 26 Department of Defense (DoD) agencies. Also located here are a Marine Corps detachment, a U.S. Air Force activity, and an agency from the Department of the Treasury.

Straddling Northern Virginia's U.S. Route 1, Fort Belvoir is divided into two halves, known as the North and South Posts. The Master Planning Concept Map of May 2002 designates RCI areas on both halves. These originally designated RCI lands correspond to the location of the existing Post villages as well as adjacent areas. Existing family housing at Fort Belvoir is grouped into 12 distinctly identifiable housing areas located throughout the cantonment area of the post, and occupies approximately 535 acres.

The Fort Belvoir community is served by two existing Village Centers that provide a variety of commercial/retail, recreation and services facilities. Located on the North Post are the Post Exchange (PX) and Commissary, PX gas station and various other retail and recreation facilities that support the military community. On Fort Belvoir's South Post are the Home and Garden Center, PX gas station, car and truck rentals, credit union and various retail facilities as well as the post library, chapels, Child Development Center (CDC), field house, hospital and other support activities. All of these facilities are essential to making Fort Belvoir a great place to live and work.

The family housing at Fort Belvoir can be divided into two broad categories, non-historic, and historic housing. Both are, for the most part, inadequate when compared with the current market standards or military standards. Overall, the current housing villages are somewhat scattered and appear isolated from one another, despite the connecting roads and trail systems.

The housing villages have generally been built on both the flat and rolling terrain of the area. The older village's trees are adequate and mature, giving the area a friendly and inviting appearance for the most part. In most cases throughout the rest of the military housing community of Fort Belvoir, even though villages are adjacent, they are not interconnected, and blocks are unusually long (due to topography), which discourages walking. Adjacent villages possess little or no individual physical identity that distinguish one from another.

2.2 Site Constraints and Opportunities

The site has a number of environmental constraints that will be respected during the design, construction, and property management process. These are described in more detail within this document.

Topography

The topography of Fort Belvoir consists of two nearly level plateaus that run south-southeast towards the Potomac River, and slope to lowlands that are primarily associated with Accotink and Dogue Creeks. Slopes, ravines, and stream valleys surround the two plateaus on the east, south, and west sides. The installation ranges in elevation from approximately mean sea level (MSL) along the Potomac River to 230 feet above MSL at the intersection of Beulah and Woodlawn Roads. Uplands and plateaus make up about 40 percent of the Main Post's land area, lowlands make up another 40 percent and slopes make up 20 percent.

Floodplains

Approximately one-third of River Village is currently occupying area that is below the estimated FEMA flood plain level of 10 feet. The redevelopment of this village may occur after the Initial Development Period (IDP). Any redeveloped homes within this area will be constructed above the flood plain as required within current building codes and any redevelopment of River Village within the current flood plain and RPA area will not exceed the existing area of impervious surface.

Floodplain elevations along the Potomac River and Dogue Creek are taken from FEMA and are based on North American Vertical Datum 1929 (NAVD29). The topographic survey information is believed to be in NAVD88. The difference between the two datums is approximately 0.8 feet. If a conversion were applied to the FEMA elevations to match the datum of the topographic survey, the conversion would lower the floodplain by about 0.8 feet. No conversion was used at the CDMP stage due to the conservative approach of the CDMP. At the time of final design, the appropriate conversion will be applied, and the floodplain areas are expected to be reduced accordingly as compared to the floodplain indicated on the CDMP plans.

Existing Waterways and Water Bodies

On July 30, 1998, the Potomac River was designated an American Heritage River under the American Heritage Rivers Initiative. The initiative is designed to help communities restore and protect their river resources in a way that integrates natural resources, economic development, and the preservation of historic and cultural values.

There are seven identified main watersheds on Fort Belvoir. The three largest watersheds originate off-post: the Accontink Creek watershed, the Dogue Creek watershed, and the Pohick Creek watershed. The majority of water from within the installation boundaries flows into these watersheds.

Existing Vegetation

Fort Belvoir is home to three major natural resource areas including the 146-acre Jackson Miles Abbott Wetland Range, the 1,360-acre Accotink Bay Wildlife Refuge, and the 742-acre Forest and Wildlife Corridor. The forest and wildlife corridor connects the Huntley Meadows County Park just north of the installation to the Wetland Refuge. The corridor continues through the installation to the Wildlife Refuge and on to the Mason Neck State Park and the Potomac River National Wildlife Refuge Complex south of the installation.

Fort Belvoir has a multitude of specimen trees that lend stability and character to the residential communities. The preservation of the existing trees will be considered for any proposed development.

Existing Roads
The installation is well serviced by a clear arterial road network with greater regional connections provided by Route 1, Interstate 95 and the 495 Capital Beltway. The existing housing areas are serviced by a variety of internal networks.

Existing Land Use
The land use within the post consists of operations and maintenance, troop accommodation, administration, recreation and family housing. The structuring of these land uses generally forms a stratified land-use pattern consistent with military-post planning principles.

Existing Buildings
There are currently 2,070 dwellings within the family-housing areas, with associated schools and community buildings.

Existing Main Utility Lines
The Development Plan anticipates the utilization of the existing street and utility infrastructure whenever possible. Existing utilities lines not being reused will be abandoned or removed. The new housing will be located to minimize the impact on existing services capacity. Where the land plan requires, new utility mains will be built in conjunction with the infill roads and tied into the existing mains at the street intersections. New service laterals will be built from the new homes and tied into the existing mains.

FBRC will study the various utility systems affecting the housing areas in conjunction with the local utility providers who own, maintain, and operate the utility mains. FBRC will work closely with the garrison and the Defense Energy Support Center (DESC) during the utility privatization process to determine responsibilities pertaining to construction, ownership and maintenance of the various utility systems.

Identified Archeological Sites
Twenty-two (22) potential archeological sites have been identified in or adjacent to the RCI footprint. Several of the RCI sites have already been tested and evaluated. At this time, it has been determined that of the sites within or adjacent to Project areas, at least 5 are ineligible.

Noise-Affected Zones
The housing areas of Fort Belvoir are generally clear of major noise impact from installation facilities. However, the key potential noise impact for the housing will be the existing arterial road network. All home replacement, new housing, and renovation activities will need to respect distances and sound-mitigation techniques. The master plan includes buffer zones with trees and other vegetation to reduce the impact of road noise. Sound walls and other structural barriers are not anticipated as part of this construction.

2.3 Neighborhood and Planning Principles

A broad planning process has been developed with the objective of creating viable and workable neighborhoods and villages. These social and spatial planning concepts and the components that build them are listed below. The work to be undertaken within the RCI program will serve to reinforce these planning principles:

The Streetscape
The component directly adjacent to the dwelling. This is arguably the most highly valued and best understood part of the urban environment. Most people typically know six or more households on their street, and will be greatly interested in its appearance and functionality, especially regarding safety and traffic.

The Block
The component recognized as an area to walk around. Homes and buildings are contained on blocks in which neighbors regularly interact with one another. Blocks should contain recreation and playgrounds for safe and convenient use by families living on the block.

The Neighborhood
The grouping of 200-500 families within approximately a quarter-mile radius to allow a five-minute walk from the center to the edge. The scale of the neighborhood is small enough for neighbors to know one another. Neighborhoods may contain computer centers, meeting rooms, recreation facilities or playgrounds for convenient use by residents of the neighborhood. Larger neighborhoods may also contain a property management office.

The Village
The grouping of 600-1500 families within approximately a three-quarter mile radius to allow a fifteen-minute walk from the center to the edge. Villages, made up of multiple neighborhoods, typically offer a wide variety of quality of life amenities including a village center organized around a village green, schools, a church or meeting hall, shopping, recreation, daycare centers, playgrounds, meeting spaces, property management offices, or outdoor activity spaces, all easily accessible by the resident families.

The Village Center
The village center is the focus of the village. Typically located in the geographical center of the grouping of neighborhoods, this location may shift if so determined by environmental opportunities. The village center may contain facilities such as a community clubhouse, shoppette, and a village park. The village center will often relate to the open-space network and natural drainage systems.

The composition of these elements will respond to the following guiding principles:

- The creation of an enhanced connectivity between housing areas, schools and community / recreational facilities.
- Provision of a usable, functional and integrated open-space network between and throughout all villages.
- Provide a “social infrastructure” through the development of community and recreational facilities.
- Establish street systems that reduce pedestrian / automobile conflicts.
- Design “walkable” communities and reduce car dependency.

Traditional streetscapes and open space networks will connect blocks to create neighborhoods and neighborhoods will combine to create the villages. These special residential neighborhoods and villages will be served by a mix of support and life-fulfilling uses. Places such as shops, town halls/community buildings, athletic/wellness centers, and play fields will be part of every village to support the full range of life’s activity.

Our goal is to provide military families living at Fort Belvoir with an enduring, once-in-a-lifetime experience and memory of their time spent in the Nation's Capital. Our plans for developing, operating and maintaining this high quality family community include village and home designs using proven, traditional design principles and techniques to encourage residents to interact with their neighbors and take advantage of everything their homes and villages offer. At Fort Belvoir, our designs create a "sense of place" where smaller, human-scaled villages offer their own unique character and architectural style. This cohesive community design approach reinforces each family member's connection to his or her community, and transforms the house into his or her home. Each revitalized village will have new single family detached, duplexes and town homes with distinctive architectural style.

Whenever practical, the homes at Fort Belvoir will be designed and carefully placed to take advantage of the beautiful views surrounding the Potomac River, Dogue Creek and the rolling hills of northern Virginia. In all villages, quiet streets will be designed to decrease vehicular traffic by parking in the rear of the homes to increase pedestrian safety, and encourage vigorous runs and leisurely family strolls. Both private fenced-in backyards and public play areas near homes provide parents and children the security of knowing that each is within sight and a shout away. Village Centers with park-like green spaces that invite residents to take leisurely strolls or have impromptu gatherings with friends and neighbors will be provided.

The new designs will also introduce concepts of street design and public open space networks. These will be scaled to create more connected residential groupings that reinforce a better sense of community. Design concepts will also incorporate the following:

- The homes, amenities and open spaces will be designed on a human scale so that each village and block has a comfortable feel that encourages people to use the public realm.

- Where appropriate, long blocks of houses on existing streets have been shortened, with sidewalks on both sides of the street to create a more pedestrian-friendly setting.

- Covered parking for residents will be in 2-car garages conveniently located to the sides or rear of each home, so that street views are attractive and the neighborhoods are pedestrian-friendly.

Well-lit streets, lined with shade trees and sidewalks will be designed to be shared by pedestrians and cars. Slower traffic on residentially scaled streets will create a safer, pedestrian-friendly environment. Interconnected streets on shortened blocks will offer a variety of routes so that pedestrians and cars can move more easily to conveniently located destinations within the village.

The housing types and styles reflect the regional culture and tradition of Virginia. Each village will have its own identity relative to landscaped village entry features, architectural style, house types and amenities. This approach avoids "cookie-cutter" homes by creating streets that contain homes with unique facades, colors and roof lines mixed with a variety of housing types and sizes to give each family a sense of pride and identity in where they live. Village features will include:

- Unique entrance features into each village with signage and landscaping to reinforce the individual identity of the community.

- With villages sized to be no more than a 5-minute walk from center to edge, and tot lot and play areas that are no more than a 2-1/2 minute walk from any home, we have encouraged convenience and pedestrian activity.

- Common ancillary amenities so that each village contains certain basic comforts (i.e. playgrounds, tot lots, recreation facilities). Unique amenities will also be constructed to reinforce each village's distinct identity. The architectural style of the amenity buildings will be coordinated with the overall design so there is continuity of the architectural character as a whole.

- The plan for open spaces has been designed to encourage safe use of parks, village squares, bike/jogging paths, and playgrounds that are integrated with the natural terrain of each village. Well-lit, landscaped, public areas, such as parks and playgrounds, will be designed to create clearly defined spaces.

- Unique amenities and ancillary facilities are placed to encourage residents of other villages to use them, thus promoting interconnections both physically and psychologically within the Fort Belvoir community. This commitment to connectivity will be further reinforced within each village by establishing clear links between villages through the network of streets, and walking paths.

2.4 Environment Planning Principles

Environmental stewardship is a critical component of our strategy for the development of new homes at Fort Belvoir, and for the ongoing long-term operation and maintenance of the homes at all of the family neighborhoods. Our approach, as proactive partners with the Army, is characterized by one overarching concept: to practically integrate human habitat and a healthy natural environment, so that the long-term use and viability of the homes and the overall residential communities will be enhanced and preserved. The key elements of our proactive approach to environmental stewardship include:

- **An assessment of existing conditions.** Prior to new construction, demolition or substantial rehabilitation, environmental and existing condition assessments will be completed as required by applicable Federal and State laws, rules and regulations to analyze existing wetlands, endangered species, existing grades and potential environmental hazards. Further, FBRC will coordinate all new construction, demolition and rehabilitation efforts with Fort Belvoir Department of Public Works and Logistics (DPW&L).

- **Conservation.** Clark Pinnacle is committed to the introduction and maintenance of Best Management Practices (BMP) in the use and conservation of energy and water. We envision a system that will promote minimum utility costs to the residents, while at the same time rewarding them for conserving energy.

  The General Conformity Analysis indicates that annual emissions from both stationary and construction activities will not exceed the *de minimis* level required by the Clean Air Act at any point during construction. These conforming levels will be maintained by controlling phasing of the construction during the IDP. If required, Clark will provide a refined estimate of NOx emitting equipment usage on an annual basis.

- **Energy efficient materials and systems.** With regard to achieving energy conservation through the use of energy efficient materials and systems, Clark Pinnacle will continue our normal strategy of using energy-efficient building materials and systems available. New construction will use standard energy-efficient techniques for the walls, roofs, and windows, and renovations will use energy-efficient components to replace the old systems where appropriate. Heating and ventilation systems will be installed that have been designed to meet ENERGY STAR® standards.

- **Connectivity.** One key to the success of an ecologically friendly neighborhood/village is an understanding of the natural environment and the connectivity required to keep these systems intact. Neighborhood block structures will be studied to promote these connections. These plans explore existing and proposed natural systems that effect the planning of the new and revitalized neighborhoods and connect villages and neighborhoods through a network of roads, sidewalks, paths, parks and open spaces.

- **Pedestrian friendly design.** The block structure also strengthens the neighborhood goals. With houses that front the street, private driveway systems that direct parking in specific areas, and public open spaces, the neighborhood becomes a pedestrian friendly community. Open space is located within a two and a half-minute walk of every residence in every neighborhood.

- **New infill neighborhoods.** The new infill neighborhoods have been carefully planned to be integrated and placed into the natural surroundings to utilize and connect with existing infrastructure and to preserve existing grand trees.

- **Multi-modal transportation network reduces need for car travel.** Sidewalks and bicycle paths provide opportunity for travel throughout the site without a car.

- **Reduced impervious surface area throughout.** A series of open spaces and natural absorption areas are designed as multipurpose recreation areas and parks that connect pervious surfaces throughout the plan.

- **Street trees and yard trees.** Our plan promotes the use of trees throughout, and utilizes large shade trees along paved streets to reduce the heat-island effect.

- **Encourage use of native plants, shrubs and trees, and avoid mono-cultures: the use of single tree species on site.** Most important to the survival of the natural environment is positive native vegetation management to minimize any additional disturbance and distribution of invasive plants. Creating healthy soil by mulching and encouraging below grade animal habitat will encourage deeper tap root type trees to flourish minimizing erosion.

- **Minimized development on slopes of greater than 15%.** This action will reduce erosion problems and its corresponding affect on water quality.

- **Site plan demonstrates a reasonable balance of cut and fill.** This environmentally sensitive and cost-effective approach to redevelopment and infill of neighborhoods minimizes the transport of material onto and off of the site.

- **Recycle as much demolished building material as practical.** This minimizes the landfill of building materials.

- **Use Best Management Practices (BMP) to control and disperse storm water on site; create Bio-retention swales, planted with grasses, shrubs and other wet-soil adaptive species.** The bio-retention swales double as protected wildlife habitats integrated into the surrounding neighborhood. They are planted with herbs, grasses, shrubs and moist to wet adaptive trees. Bio-retention swales also serve as a natural storm water management system. Larger bio-retention swales may promote connectivity and protection of larger and more vulnerable plant species.

2.5 New, Replacement and Revitalized Dwellings

The existing housing will be handled in one of two ways:

1. Demolition: Most units will be removed completely. These units will be selected based on location, condition, and livability. Selected units will be removed to provide village restructuring opportunities and amenities.

2. Rehabilitation: All retained units will be rehabilitated and maintained to comparative private sector practice over the life of the program.

   The interiors of the historic homes will be modified and updated to gain the best functional use of the available interior space with review and approval by appropriate agencies.

3.0 COMMUNITY PLANNING

3.1 The Development Plan

The Development Plan establishes a long-term framework for development on the installation. It outlines current and future development areas, primary road transportation networks, and open-space networks. The key elements of the development plan have been derived from the existing environmental conditions of the installation, together with the village and neighborhood planning principles outlined previously, serving to provide a reliable basis for ongoing detailed land-use planning and urban design. The key development plan elements are the land-use pattern, open-space network, circulation networks, and center locations.

Land Use Pattern

Traditional streetscapes and open space networks will connect blocks to create neighborhoods and neighborhoods will combine to create the villages. A mix of support and community facilities will serve these residential neighborhoods and villages. Shops, town halls/community buildings, athletic/wellness centers, and play fields will be accessible from every village.

Open-Space Network

The open-space network is a continuous system aligned with the natural drainage corridors and, where practical, integrating other areas of environmental significance, such as high points and existing vegetation. This facilitates a path-and-cycle-way network that is situated in a natural setting suitable for providing a strong, safe pedestrian network. The open-space network further serves a dual purpose as a storm water regulation and water quality improvement management system.

Circulation Networks

In some cases at Fort Belvoir, even though neighborhoods are adjacent, they are not interconnected, and blocks are unusually long (sometimes due to topography) — which discourages walking. Pedestrians and cyclists will be accommodated through a series of pathways, both on and adjacent to road locations and via pathways constructed in conjunction with the open-space network.

Centers

The new village plans provide a variety of amenities and assets to enhance the military families' quality of life. Most villages will be oriented around Neighborhood Centers for small gatherings such as neighborly get-togethers and family birthday parties, with a kitchen, meeting/activity rooms, computer centers, and rest rooms. The Centers will also contain property management offices that are readily accessible to local families. These centers will be located in New South Post, Woodlawn, Lewis Heights, Fairfax, and George Washington Villages.

Across from the Belvoir Chapel on 12th Street a large new Community/Recreation Center with exercise rooms, an Olympic-size indoor pool, full sized basketball court, racquetball courts, and other family oriented facilities is proposed.

3.2 The Village Structures

In planning and designing the revitalization of Fort Belvoir's family housing areas, the goal is to provide the military family neighborhoods with community assets that offer a high quality of life. The following village plans allow for the development of more homes than are being demolished and renovated. This gives the plan the flexibility to react and adapt to sensitive conditions that are discovered as development progresses. For example, if we find that wetlands in one neighborhood are more expansive than currently believed, this plan gives us the flexibility to

shift homes away from the wetlands and into another village in order to be able to avoid as much wetlands as practical. However we do not plan in this project on having more homes occupied than exists in the current inventory of 2,070 nor do we plan on building more homes in any one village than is shown in the "up to" numbers provided in the following sections.

North Post

The North Post is home to the Jackson M. Abbott Wetland Refuge, a large environmental preserve that forms part of a wildlife corridor linked to Fairfax County's Huntley Meadows Park. The North Post also contains extensive community facilities including the Commissary, PX and Fort Belvoir Elementary School.

The North Post contains two large family housing neighborhoods, Lewis Heights and Woodlawn Village. Lewis Heights was built in the late 1950's and is a community of brick apartments. Woodlawn Village was built in the early 1980's and is a condo style attached development.

Home to JENL, JNCO and SNCO in distinct, but adjacent areas, the new layout for Lewis Heights takes its inspiration from the existing road layout, and features a radial plan centered on a Neighborhood Center within formal green, lined with single family attached and detached houses. Two roads radiate out from this central space: one to the northeast contains both a small formal tree lined park, as well as large recreation field and play space beyond; while another green to the southeast opens to a view of the Woodlawn Plantation. We have been careful to assure a verdant open space that serves as a visual and physical connection between this important historic resource and the new homes of Lewis Heights. Lewis Heights will include 290 new attached and detached homes for JENL, JNCO and SNCO and their families.

The largest family housing area at Fort Belvoir, Woodlawn Village, will be the setting of 450 new homes for JENL, JNCO and SNCO. As in other neighborhoods JENL and JNCO neighborhoods will be distinct, but adjacent to SNCO. Located at the eastern edge of the Jackson Abbott Wetland Refuge, the existing perimeter road will be entirely preserved and will be addressed in the proposed neighborhood plan as an edge that allows all of the residents an access to the fabulous natural views across this preserve. Many of the new homes will also face onto the wetland preserve from across the loop road. One can imagine evening strolls along a the walking path along this parkway edge as an opportunity to enjoy views of wading herons and other native birds while greeting neighbors sitting on stoops or porches across the street.

At Woodlawn Village's center is a large park, serving as a community gathering and recreation space complete with a Neighborhood Center, recreation amenities, pathways, a picnic shelter and large grassy areas for pick-up games, and running and playing opportunities. This space will also provide natural planted areas – bio-swales- for storm water recharge. The residential blocks are designed to link the central park and the perimeter road edge with a series of small parkways. These open roadways will create a continuous visual relationship between these two types of green spaces in an 'emerald necklace' arrangement, allowing virtually every resident a constant connection with the natural environment. Woodlawn Village will be made up of single-family houses, with a series of town homes and duplexes along the village center and some of the parkways, to provide architectural accent and spatial enclosure.

The following table illustrates the current and proposed family-housing inventory at each neighborhood in North Post. Of special note, the proposed number of homes is under review and is subject to change.

Neighborhood	Current	Proposed
Woodlawn	444	Up to 410
Lewis Heights Village	428	Up to 300
Total	872	Up to 710

South Post

From the picturesque and historic Belvoir Village to the newly constructed South Post Village, the villages on the South Post are as spatially diverse as the landscape in which they occur. Historic designations, steep terrain, drainage swales, wetlands, water views and tree saves are among the many factors, both natural and man-made, that combine to provide distinctive and challenging sites. Unfortunately, these factors have also resulted in villages that, in the past, have been designed and developed in partial isolation from one another and the community facilities of the Post.

Responding to this planning legacy and the challenges offered by the site, the new South Post villages are linked together with an existing roadway network, and a common organizational strategy centered on the Village Green and the South Post Town Center. At the same time, each of the South Post Villages are oriented towards their magnificent views, whether they be of the naturally occurring forested swales, Dogue Creek or the marvelous green spaces of historic Fort Belvoir.

For example, the new George Washington attempts to make better use of its waterfront locations, sharing views of the existing marina and Dogue Creek. Meanwhile, historic areas, such as Gerber Village, Belvoir Village and Jadwin Loop are planned to center around bucolic central greens, contributing to their character by reinforcing their neighborhood structure.

Dogue Creek provides an important visual amenity as the potential for creating an area that engages the waterfront becomes apparent. River Village and George Washington Villages currently turn their backs to this underutilized amenity. The master plan vision develops a way that the waterfront area can unify these villages rather than divide them. From every approach, these waterside villages join through visual, pedestrian, and vehicular connections.

From the high end of the George Washington Village Green, the layering of vistas is obvious. Glimpses of the marina emerge in the distance, while the park system provides an informal terminus on the green. Additional greens, some lined by homes for Junior Enlisted and Junior Non-Commissioned Officer (JENL/JNCO), others lined by Senior Enlisted (SNCO) allow more residents to share in views of Dogue Creek.

Colyer Village and Rossell Loop are smaller villages of 85 and 80 homes, respectively, attached to the South Post Core area as charms on a bracelet. The new entrance to Colyer will be created around a neighborhood green with homes fronting along its length. Colyer and Rossell are design to follow, where reasonable, the existing road layouts in order to preserve tree canopy and minimize grading. Each village provides several intimate community greens allowing for tot lots and informal recreation space. Colyer Village is composed of homes for SNCOs exclusively, while Rossell Loop provides residences for Company and Field Grade Officers.

Marked by small green at the intersection of Forney Road and 21st Street, at the southern edge of the parade ground, stands the entrance to Fairfax and Belvoir Villages. Fairfax is designed to

provide residences for 130 officers and their families, as well as a distinct area for Sergeants Major families. Fairfax Village is designed to utilize the existing roadway network where possible, including a southern connection to Belvoir Village, enhancing the roadway network to create an inviting village green. At the head of this green, opposite the Belvoir Village connection will be a Neighborhood Center serving both villages.

The provision for a mix of single family detached, duplex and town homes requires the construction of a New South Post Village on previously undeveloped land. This New South Post Village is made up of three, characteristically distinct, yet well-linked areas completing the northern geographic "edge" around the South Post Town Center. The first of these three areas is bordered by Gunston and Belvoir Roads, the golf course, and 12th street, which is envisioned to become the South Post's "Main Street." Imbedded in this neighborhood are a number of existing Post-wide amenities including the Post Chapel, day-care center, fitness facility and the Post Library. In keeping with its "in-town" location, this neighborhood will be made up primarily of town homes and duplexes.

The families residing here will find the essential services and administrative areas of the Post an easy walk from their front door. The town center strategy outlined here includes the creation of a Main Street along what is now 12th Street and aligning it with significant architectural facades that frame the space of the street and animate it with shop windows and activities. The Clark Pinnacle Welcome Center will be located here as well as a unique housing type -- the live-work unit. These exciting townhouses will provide Company Grade Officer's (CGO) and Senior Non-Commissioned Officer's (SNCO) families the opportunity for the kind of urban lifestyle that young professionals in the private sector are increasingly demanding. Their homes will be located above a ground floor space that will be available for retail and/or service opportunities (e.g., coffee shops, video rental stores, tax preparation services and the like). These spaces will be available for lease as the South Post Core expands. The Belvoir Master Plan in coordination with this CDMP imagines a complimentary type of development on the other side of 12th Street completing the Main Street theme.

Adjacent to this new village to the southeast, across a realigned Belvoir Road, another area of New South Post Village completes the core ensemble. Large and elegant townhouses for Company Grade and Field Grade Officers will align the eastern edge of Belvoir Road, providing a dignified face fronting onto the South Post's main recreation green. The Village is designed to integrate the continuing education opportunities provided at the adjacent Barden Education Center and the recreational amenity of the existing Teen Center as it completes the South Post Core.

The combined areas in New South Post Village will house 403 homes, with homes for JENL, JNCOs, SNCOs, Company Grade and Field Grade Officers.

The following table illustrates the current and proposed family-housing inventory at each neighborhood in the South Post. Of special note, the proposed number of homes is under review and is subject to change.

Neighborhood	**Current**	**Proposed**
Fairfax Village	148	Up to 120
Belvoir Village	61	Up to 66
Rossell Loop	60	Up to 75
Gerber Village	76	Up to 81

Jadwin Loop	45	Up to 60
Park Village	14	Up to 27
Colyer Village	92	Up to 80
George Washington Village	244	Up to 210
New South Post Village	0	Up to 410
Total	928	Up to 1,129

Potentially Developed After IDP

River Village	188	Up to 145
Dogue Creek	270	Up to 145

4.0 PUBLIC DOMAIN AND LANDSCAPE

Over the 50-year project life of Fort Belvoir Residential Communities, the approach to the natural environment globally will change significantly. With the current goal of being responsible stewards of our environment, new development will need to be undertaken with a long-term management strategy influenced by best practice procedures.

Planning principles established for improvements to new and existing housing are based on an understanding and respect for the natural systems. The proposed new development will sit lightly on the land taking advantage of the unique natural surroundings while mitigating any potential negative effects to the environment and character of Fort Belvoir.

The Regional Context

Fort Belvoir is situated on the historic William Fairfax's Belvoir Plantation; hence, the landscape architecture treatments as well as the architecture attempt to emphasize its rich historic legacy. The landscape plan adopted for Fort Belvoir during the 1920's exemplified Army efforts to improve the quality of life for its personnel and the aesthetic beauty of its installation. George B. Ford, planning adviser to the War Department during that period, encouraged installations to turn away from more formal, traditional planning practices, particularly the use of straight lines and monotonous patterns. He advocated creating useful, aesthetically pleasing environments that took advantage of natural vistas and used irregular lines. Quartermaster Corps officer First Lieutenant Howard B. Nurse also influenced Army planning at this time. Like Ford, he advocated the integration of natural topography in the design and layout of streets, especially in residential areas. The results of Nurse's and Ford's philosophies are most apparent in the configuration of the officers' housing sections at Fort Belvoir today as well as in the proposed Master Plan.

It is the goal of this project to integrate the patterns of the natural landscape with the development. It is precisely this natural landscape character that not only inspires a truly sustainable environment, but also makes the most sense from an aesthetic standpoint.

Design Goals

- Provide a diverse landscape across the Post that takes advantage of the unique features and natural environments in the Post.
- Establish a long-term strategy to integrate quality water management practices into the design development.
- Integrate the outdoors at every level: community, village, home.

- Initiate a landscape management policy that will accommodate a naturally changing landscape.
- Establish an open-space network as a tool for community education.
- Enhance the sense of pride, safety, community, continuity and ownership associated with the Fort Belvoir Residential Communities.
- Use the historical patterns of vegetation as an inspiration for land management and design.
- Plan for landscape improvements that will ultimately improve residents' attitudes about their time at Fort Belvoir.
- Create community gathering spaces with strong sense of place where families and residents of Fort Belvoir can come together.

Design Concept

Each neighborhood will have its own identity, which will be reflected in a unique palette of plant materials that will be used extensively and solely in that community. For instance, Woodlawn Village, overlooking the beautiful marshland grasses, might feature native ornamental grasses, sedges, and day lilies.

The plant material palette for each individual neighborhood would be tailored to the neighborhood based on the neighborhood's solar orientation, topography, natural setting, and architectural scale. Perennial flowers and bulbs would be carefully chosen for each neighborhood and matched to the shrubs and trees selected for that neighborhood. Residents would be given a palette of recommended plant material and garden ideas that would carry out the theme and landscape character.

The formal public open space in each neighborhood will reflect a manicured and urbane character. Using historic colonial elements found in Virginia, the streetscape will feature wide tree-planting strips between the curb line and sidewalk. These tree yards will contain large broad shade trees to provide a continuous leafy canopy over the streets. The sidewalks will be placed on both sides of all the streets in the neighborhood. The street tree palette for that neighborhood will further define its uniqueness and identity. Street lighting will be selected to reflect the colonial architecture. We will explore different lamppost or lamps for each neighborhood. The precinct between the sidewalk and residential facades will be carefully designed for each neighborhood.

Military housing is notoriously lacking in a "layered" approach to landscaping; however, we are proposing to provide just such an approach. In addition to the large street trees we will plant lower understory ornamentals. These ornamentals provide a changing palette of color to the neighborhoods. A layer of hedges and shrubs will soften the transition from yard to buildings providing an evergreen definition of individual yards. Finally, we will use a groundcover and low shrubs layer to accentuate entrances and add interest to the streetscape.

The following outlines the community's landscape features and the design approach to each element.

Village Connections

Village entrances' will be selected to reflect the colonial architecture and will punctuate roadways and provide identity as well as markers for each neighborhood. The roadway image will be further amplified by the willow and street tree planting regime and common understory

landscape vocabulary of broad waves of cascading plantings. The entire effect of the village connections will be of a continuous beautiful thread tying one neighborhood to the next.

Sidewalks
Sidewalks will be provided on both sides of the neighborhood village streets. The sidewalks will be 4' in width.

Community Open Space and Ancillary Facilities
Each neighborhood has at least one community green, designed in the manner of Early American town greens. These community spaces occupy a central and prominent location in each village, with many of the neighborhood streets and major drives leading into the green. These greens will also be unique in design for each neighborhood. They could contain perhaps, a gazebo or a bandstand for sheltered seating and performances. They will have play equipment and benches. While the landscape treatments will be more formal and gardenesque than community parks, they will be designed to accommodate a wide range of passive and active community functions. For example, several will be large enough for informal playing fields, while others will include naturalized planting areas or gardens to facilitate ground water quality improvements. In selected villages, the focal point of the greens will be a recreation and civic building designed to compliment the surrounding neighborhood homes.

Community ancillary facilities and parks will be distributed throughout the community and provide residents with more structured play and recreation. However, even these parks will not be simple large expanses of grass, they will be landscaped with trees and shrubs breaking down these large expanses into several outdoor "rooms" containing multi-use fields with shade tree fringes.

Trees
Reforestation of Fort Belvoir will be accomplished through our street tree program and our village greens and community parks. Where possible we will preserve the existing tree stands and utilize this structure in the designs of the village housing program and community open space. While the majority of the Post has a mature forest stand, our planting program will begin to establish the next generation of forest canopy.

New Housing Gardens
The architectural design of each housing unit was conceived with the idea of providing physical and visual connections to the exterior environment. With this in mind the landscape treatment reinforces the architectural design. The landscape of the individual units will provide for a strong and easily maintainable landscape framework that allows for individualization by residents.

Yard Fencing
Each new unit will receive fencing to enclose the rear yard. The fencing will be semi-opaque wood fence at 3 to 6' tall.

Vegetation Clearing Plan
The goal of the master plan is to preserve the existing forest stands where possible. This includes limited disturbance to the forest floor and the herbaceous layer of ground cover.

Tree protection measures will be used throughout the development. Areas of existing forest identified to be saved will be identified before construction and clearly identified on site by a combination of signage and fencing. In addition we will review all construction elements of

impact to the tree and forest environment to reach a balance between protection of trees and meeting construction goals.

Street Furniture

Street furniture will be selected similar to that of the street trees and street lights in that each village will possibly have a unique program of street furniture while reinforcing the overall theme developed for these residential areas. The benches will be made of wood, metal or a combination of those materials.

Street Lighting

Street lighting will be part of the fabric of each village and will be designed according to the neighborhood pattern of housing setbacks, street widths, and street tree spacing. The fixtures may be individualized in the different villages to further create a special identity. The lights may include different finials and poles and colors may vary.

Neighborhood External Lighting Plan

The exterior lighting design for Fort Belvoir will balance between providing consistent, even lighting levels for security in high pedestrian use areas while designing the appropriate foot candles usage in areas of less use to limit the amount of light pollution into the environment. Special areas will receive higher levels of illumination with different types of fixtures.

5.0 SITE ENGINEERING

5.1 Technical Standards

Electrical Utilities Design Criteria
Design criteria for electrical distribution system design will be based on those used by Dominion Virginia Power, the local dominant utility provider.

Storm Drainage Standards
The storm drainage system at Fort Belvoir is currently federally owned. The storm water management system consists of mostly of standard closed storm drain systems and open channels that receive sheet flow and point source flow from within the post's 58-sub-watersheds. The open channels ultimately discharge to the post's watercourses through approximately 118,000 linear feet of paved draining ditch and 315,000 linear feet of storm drain. Within the RCI areas the current system does not include any provision for peak flow attenuation of water quality measures. As a part of the redevelopment within the RCI areas, this project will provide proven Best Management Practices (BMP) to attempt to decrease pollution loading and stabilize flow rates.

Water System Standards
Fort Belvoir receives potable water from three entry locations: Fairfax County Water Authority meter vault/pump stations on Pole Road, Telegraph Road and Beulah Road. Fort Belvoir is considered a consecutive water works system by the Commonwealth of Virginia because it buys its drinking water from Fairfax County for on-post distribution and also sells water to customers of the installation who do not have a direct water service connection to the County. The installation's status as a consecutive waterworks requires the installation to produce its own water quality reports.

The master community plan anticipates the utilization of existing water distribution systems. New mains will be constructed per Fairfax County Water Authority (FCWA) the utility providers' standards only in locations where new streets are added to service infill homes and connected to existing mains where the streets meet existing streets. New service laterals will be added at each house and run to its point of connection at the existing main. The new service laterals are anticipated to benefit the overall community by reducing water loss from existing connections, which have degraded.

The water supply system for the privatization of Fort Belvoir Residential Communities shall conform to applicable Federal and State codes for "Public Water Drinking" systems. These specifications have been adopted to ensure regional options are considered, consummate with public health design criteria, in compliance with existing State statutes and in accordance with good public health engineering practices. Variance may be required in respect to the measure of demand for service, and shall be determined based on actual measured flows.

Sanitary Sewer Standards
Fort Belvoir owns and maintains the on-post sanitary sewer systems, which is comprised of approximately 380,000 linear feet of service laterals, collection pipes and mains with 1,697 manholes, 34 lift stations, and two main pumping stations. The installation also owns and operates two ferrous sulfate sewage treatment facilities.

The master community plan anticipates the utilization of existing sanitary sewer mains. New mains will be constructed per FCWA only in locations where new streets are added to service

infill homes and connected to existing mains where the streets meet existing streets. New service laterals will be added at each house and run to its point of connection at the existing main. The new service laterals are anticipated to benefit the overall community by replacing degraded existing connections.

The sanitary sewer system for the privatization of Fort Belvoir Residential Communities shall conform to the applicable codes for "Design Criteria for Sewerage Systems". These design specifications are the guidelines to be used for the comprehensive consideration of domestic sewage collection, treatment, and disposal systems, establishing the minimum design criteria pursuant to existing state statutes pertaining to effluent quality meeting State water quality standards. These criteria are intended to promote the design of facilities in accordance with good public health and water quality engineering practices. Variance may be required, with respect to the measure of demand for service and shall be determined based on actual measure flows.

Gas Standards

Gas distribution mains are currently owned, maintained and operated by Washington Gas. The master community plan anticipates the utilization of gas mains. New mains will be constructed or relocated by the utility provider and shall conform to the code and design criteria established by them.

5.2 Demarcation

Neighborhood Extensions and Infill Dwellings

Within the areas of neighborhood extensions and infill dwellings, the utilities shall be designed and constructed to connect into the existing service. Demarcation of all utilities will be as outlined in the U. S. Army Memorandum, HeadQuarters Department of the Army (HQDA), Assistant Chief of Staff for Installation Management (ACSIM), (DAIM-FD) Memorandum, May 31, 2001, Privatizing Utility Systems.

Replacement Dwellings

Where existing dwellings are being replaced with new dwellings, the area will be treated as new development relevant to utility distribution. Accordingly, the construction of utility infrastructure will be as outlined during negotiations between Clark Pinnacle, RCI, the Army, DPW & L and DESC as utility privatization and negotiations with existing utility providers takes place. Demarcation of all utilities will be as outlined in the U. S. Army Memorandum HQDA, ACSIM (DAIM-FD) Memorandum, May 31, 2001, Privatizing Utility Systems.

5.3 Integrated Utilities

The single ownership of land, the reduced levels of easement requirements, and the form of the new residential blocks allow for efficient utilities designs. This efficiency is gained by

- Utilities being run in common trenches, where practical.
- Ensuring that "off the shelf" products are incorporated into the design (i.e. standard transformers).
- Minimizing piped storm water by capturing and directing storm water flows on grade.
- Close coordination of the design and installation of the utilities.
- Careful consideration of the location of the residential blocks within the surrounding topography.

5.4 Water Management

Water management is a critical design element within the proposed village developments. Residential blocks and streets are oriented to existing slopes. Street runoff will be collected and then dispersed through a series of vegetated spreader swales. The vegetation assists in pollutant clean up. The spreader swales will be perpendicular to the slope. The shallow swale allows for some absorption but primarily serves to spread and slow the flow, reducing the formation of eroded rivulets into the stream from paved areas.

The use of BMP to control and disperse storm water on site shall be analyzed for its potential utilization within the master community to create bio-retention swales, planted with grasses, shrubs and other wet-soil adaptive species. Bio-retention swales double as protected wildlife habitats that are integrated into the surrounding neighborhoods. They are planted with herbs, grasses, shrubs and moist to wet adaptive trees. The bio-retention swale also serves as a natural storm water management system. Larger bio-retention swales should promote connectivity and protection of larger and more vulnerable plant species.

5.5 Storm Water Drainage

Storm drainage systems for new houses within existing village areas will typically be integrated into the storm water management (SWM)/BMP systems to provide safe and adequate conveyance of storm water. Where practical, in the neighborhood extensions drainage will be accommodated within surface water systems designed to ensure that storm water will be conveyed away from the house into drainage swales that, in turn, will carry the flow to the SWM/BMP systems, and then from the SWM/BMP systems to a safe and stable outfall point.

5.6 Water Distribution

The design principles for the water distribution system will be to provide a reliable service to each residential unit.

When an existing residential area is increased in size, the water distribution system for that area will be studied and, if needed, a new distribution main will be installed beginning at the RCI property line to the location of the new houses. If, as a result of the new development, existing utilities are required to be upgraded beyond the line of that particular residential village, then Fort Belvoir and FBRC will work together to determine what upgrades are necessary and each will pay its “fair share” of the cost of such upgrades. Water pressures need to be evaluated to assess the ability for the existing system to provide adequate water supply and pressures.

5.7 Sanitary Sewer

The design principles for the sewer distribution system will be to provide a reliable service to each residential unit. When an existing residential area is increased in size, the sanitary sewer distribution system for that area will be studied, and if needed, a new main will be installed beginning at the RCI property line to the location of the new houses.

System capabilities at the individual villages need to be evaluated to assess the ability for the existing system to provide adequate service. If, as a result of the new development, existing utilities are required to be upgraded beyond the line of that particular residential village, then Fort Belvoir and FBRC will work together to determine what upgrades are necessary and each will pay its “fair share” of the cost of such upgrades.

5.8 Gas Distribution

The design principles for the gas distribution system will be to provide safe and reliable gas service to each residential unit. When existing residential areas are increased in size or are

dramatically rearranged, the gas distribution system for that area will be studied, and if needed, a new gas distribution main will be installed to the location of the new homes by the utility provider. If, as a result of the new development, existing utilities are required to be removed and redistributed or upgraded beyond the line of that particular residential village, it is proposed that this upgrade work be undertaken by Washington Gas, the utility provider, as is typically done in similar private development projects.

5.9 Electrical Distribution

The design principles for the electric distribution system will be to provide reliable electric service to each residential unit. Electrical distribution system will consist of a combination of overhead and underground primary service feeders dependant on the area involved and its corresponding type of construction (i.e. new or renovation). New construction may be served with underground primary and secondary service. The ability to replace overhead electrical utilities with underground services is being explored for inclusion within the RCI program but may not be adapted.

5.10 Telephone, Data and CATV

Cable Television and Telephone

The cable television and telephone system will be incorporated into the design of the new developments. Industry standards will be used for the design and construction of these facilities.

Communication Distribution System

The communication distribution system will be installed underground for all new areas of construction. In areas of renovation, the system will be a continuation of the existing overhead or underground system in place.

5.11 Hazardous Materials

Clark Pinnacle will coordinate with Fort Belvoir's DPW&L department on an Environmental Management Plan (EMP) for the project. This plan will be completed by closing and will discuss plans for managing the following hazardous materials:

- Lead-based Paint
- Lead in Soils
- Asbestos-Containing Building Materials (ACBM)
- Radon
- Underground Storage Tanks
- Polychlorinated biphenyls (PCB)
- Pesticide Management
- Mold
- Ordnance

Further, the EMP will contain a Hazardous Materials Spill Contingency Plan, complete with spill discovery and notification procedures, mobilization of response resources, emergency response actions, and post-incident follow up procedures.

The Operations and Maintenance Plans that currently exist at Fort Belvoir for Lead Based Paint, Radon, Mold and Asbestos will be utilized until such time as a new O & M Plan is completed. All toxic materials including batteries, paint, pesticides and other chemicals or hazardous waste

will be removed and disposed of in accordance with Resource Conservation and Recovery Act standards as well as all local State and County regulations.

A Certified Pesticide Applicator Contractor, in accordance with all State, Federal, and County regulations, will perform housing Pest Control. A comprehensive pest management plan will be provided by the contractor to the appropriate Fort Belvoir departments for review as required.

6.0 NEW DWELLINGS

6.1 Residential Plan Making

With the exception of the historic and historically significant homes, and the 270 homes being revitalized currently at Dogue Creek Village, all of the existing houses at Fort Belvoir have exceeded their useful life of being comfortable, functional houses. New structures will offer residents homes that are comparable to those found in the local area market. During the IDP, all of these obsolete houses will be torn down and replaced with new homes featuring modern features, and high quality materials with amenities that exceed military and market standards. These new homes will be built as detached single-family homes, duplexes and town home residences for 3-bedroom, 3-bedroom with den and 4-bedroom with den size families. The dens are sized and designed to be able to be used as an extra bedroom if needed.

These new homes are larger than current standards for military and private sector housing, reflecting our desire to provide truly exceptional homes. Taking our direction from the existing architectural style of the historic units at Fort Belvoir and the northern Virginia area, we propose three styles – Colonial, Georgian, and Colonial Revival for the new housing. These styles will create new villages that "Build on the Legacy" and history of Fort Belvoir and the northern Virginia area.

We have developed unique designs for these homes that take advantage of the beautiful rolling terrain of northern Virginia and the scenic views along the Potomac River. Contemporary floor plans with 9-foot high first floor ceilings and ample windows encourage family activities both inside and in the private outside space. The houses will be carefully placed on the site, with unique materials and façades to maximize the individuality of each home. Where possible, we will take advantage of graded sites in the various existing villages to reduce expensive re-grading, and every effort will be made to retain as many existing trees as possible within these villages.

In all of the new houses two-car garages with garage door openers will be provided and placed behind the front of the house to allow for maximum views to the street from inside the homes, and to create streetscapes that encourage pedestrian usage. In most cases, cars will enter the garages from rear driveways off an alley to improve pedestrian safety by eliminating street congestion while still allowing direct access to the kitchen areas from the garage in the individual houses.

Most of the new houses, with the exception of the smaller 3-bedroom units, will have a den and a full bathroom on the ground floor. These "extra rooms" expand both the space and flexibility of the homes, and will allow the family members the opportunity to use this space to serve the unique needs of their family as an office, den, study, computer room, sewing room, or a bedroom if needed. In addition, all homes have separate family rooms or great rooms on the first floor to further expand the living space.

Taking into consideration the frequency with which the military families move-in and move-out of the housing at Fort Belvoir, we have designed wider than normal stairwells in the new housing units to facilitate the movement of furniture throughout the house and to minimize damage and maintenance expenses that often occur during the moving process. All homes will also have 9-foot ceilings on the first floor, which will make the units feel even more spacious. High quality and energy efficient appliances, materials, and systems will be used to ensure durability and

reliability. All homes will also have separate laundry rooms or laundry closets and generous interior and exterior storage to accommodate the special needs of military families.

To enhance the connection of the families to the outdoors, each house is designed with patios at the rear, accessible from the family rooms via French doors. Also, fenced back and side yards will provide more privacy for safe play for small children, family activities, or quiet entertainment. Homes will be beautifully landscaped to soften the edges and to give each home its own identity. Where topographic grades are an issue, unfinished basements will be provided in lieu of retaining walls to assure that houses and garages are aligned and that access between them is retained. This added feature offers substantial "bonus" storage and living space for the families who will live in them.

Each village at Fort Belvoir will have its own consistent style of architecture to reinforce the unique character of the community. Whether Colonial, Georgian or Colonial Revival, each home within the village will have distinct features, with different architectural details and treatments, materials, colors, and rooflines, to reinforce the unique identity that each family has with the place they call "home". Streetscapes will be enhanced by mixing 3-bedroom, 3-bedroom with den, and 4-bedroom with den single- story accessible homes along with the two-story homes in each village.

Five percent (5%) of the homes have been designed to comply with handicap accessibility requirements under the Uniform Federal Accessibility Standards (UFAS). These homes will be interspersed throughout each village, with careful attention to their placement in the flatter areas of the site. This percent figure was determined through collaboration with the Fort Belvoir RCI staff using the Post historic handicapped occupancy and Exceptional Family Member Program (EFMP) data.

We will use low-maintenance, energy efficient materials and systems to ensure long-term durability and high-quality maintainability throughout the villages. All the new homes have been designed to meet all applicable local building codes and ENERGYSTAR® requirements.

The houses will be carefully placed on the site, with unique materials and façades to maximize the individuality of each home. Where possible, we will take advantage of graded sites in the various existing villages to reduce expensive re-grading, and every effort will be made to retain as many existing trees as possible within these villages.

Homes will be wired for high-speed Internet access, allowing friends and families to stay in touch via cutting-edge communication technology. Within the homes, fire and safety standards will be maintained to include hardwired smoke detection alarms, and Carbon Monoxide (CO) alarms.

The new homes for enlisted personnel as well as for officers reflect increasingly refined features and architectural amenities inside and out that are appropriate to rank.

The new houses will be characterized by:

- SPiRiT Gold Rating
- Foyers with tiled floors and closets
- ENERGYSTAR® certified
- 9-foot high ceilings on first floor
- A den in most homes

- Kitchens adjacent to family rooms
- Wider than normal stairwells to accommodate the frequent moves required of military families
- Quality appliances, materials, systems and finishes
- STC 26 and 30 low "e" vinyl windows
- Water conserving plumbing fixtures
- Covered entries on many homes
- Dining rooms adjacent to kitchens
- Natural flow throughout living spaces
- Kitchens with separate laundry rooms
- Powder rooms on the first floor
- Ceiling fans
- Bedrooms that meet or exceed the local market standard for size
- Closets that meet or exceed current military standards
- At least two full bathrooms on the second floor and ½ bath on the ground floor.
- Trash cans and recycling bins will be provided by the trash contractor and should be stored in the garage.
- Landscaped yards using sustainable design
- Use of modern technologies and materials that meet state codes and standards
- Smart wiring for internet access and cable TV
- Attached and detached garages with automatic garage door opener
- Basements where topography requires them. (The basements are not counted as part of the unit square footage, offering "bonus" space in those homes.)

The new homes for SNCO and officers reflect increasingly refined features and architectural amenities inside and out that are appropriate to rank. Homes for senior enlisted and officers with families will include the following upgrades above the standard, high quality features, materials and systems for JENL homes:

- Additional storage
- Upgraded interior/exterior trim packages
- More elegant and stylized facades
- Upgraded landscaping
- Soaking tub and separate shower in 4-bedroom sergeant majors and senior officer's quarters (O & N units)
- Upgraded appliances in senior officer's quarters (O unit)
- Built-in bookshelves in the den of senior officer's quarters (O unit)

6.2 Space Planning Guidelines

The basic building modules will be developed based on a repetitive dimensional system to accommodate the required spaces and usages. The use of a standard grid allows equality across different unit plans and provides the opportunity for standardized components across the range of new housing, including closets, storage, kitchens, bathrooms, and cabinetry.

6.3 Architectural Language

Our homes will have an enduring quality and an architectural character that is derived from Virginia, and that are specifically sited, when practical, to take advantage of the great landscape and the wonderful views of Dogue Creek, the Potomac River and the Jackson M. Abbott Wetland Refuge.

We have taken very special care to make our village plans and our home designs of this region — unique and authentic in style — so as to create a home that is truly desirable. Of the traditional styles that we have adopted from the Virginia region are the Colonial, Georgian, and Colonial Revival Styles.

The architectural styles and designs of the homes and villages match the quality and standards set by Clark and Pinnacle in their most successful residential communities, and complements the styles of the northern Virginia area. Housing types, facades, colors and details are mixed to create unique, diverse streetscapes. This diversity avoids the monolithic appearance common to many modern residential (both private and military) neighborhoods.

6.4 Parking and Storage

In most cases, two-car garages with garage door openers will be provided and placed behind the house to allow for maximum views to the street from inside the homes, and to create streetscapes that encourage pedestrian usage. Cars will enter the garages from rear driveways off an alley (in most cases) to improve pedestrian safety by eliminating street congestion while still allowing direct access to the kitchen areas from the garage in the individual houses.

With the mobile nature of the military families, adequate storage is required. All homes will have separate laundry rooms and generous interior and exterior storage to accommodate the special needs of military families.

6.5 Sustainable Design

The composition of the building envelope will be considered to optimize energy conservation and performance. This will include assessment of the primary building envelope elements and secondary insulation components. Low-maintenance, energy-efficient materials and systems will be used to ensure long-term durability and high-quality maintainability.

Consideration of maintenance of the building components and systems will be a priority in light of the ongoing property management role of the RCI program. Construction methodologies and materials will be assessed on life cycle costs including longevity, routine maintenance, replacement processes, and energy conservation. The new units will be compliant with Energy Star standards with the appropriate inclusions, such as energy saving lighting and equipment, and envelope materials.

6.6 Codes

All of the homes have been designed to meet all applicable local building codes.

Homes will be designed to the following codes as amended by the Virginia Uniform Statewide Building Code / 1997:

- Council of American Building Officials (CABO) One and Two Family Dwelling Code / 1995
- National Fire Protection Agency (NFPA) 70 – 96 National Electrical Code
- ICC International Mechanical Code - 1996
- ICC International Plumbing Code – 1995 with 1996 supplement
- Uniform Federal Accessibility Standard (for accessible units)

7.0 EXISTING HOUSING

7.1 Housing Revitalization Strategy

One of the elements that gives Fort Belvoir its sense of place and character is the buildings that make up the Fort Belvoir Historic District. The district was nominated to the National Register of Historic Places, and certified by the Virginia Department of Historic Resources in 1996. In addition to the core administrative buildings from the original Fort development, there are a number of housing neighborhoods (Villages), which are designated as contributing to the district, and worthy of preservation.

These include two areas of housing in the original master plan of Fort Belvoir, Gerber Village (1930-31) and Belvoir Village (1935-45), both designed in a colonial revival style, with Gerber Village being the smaller single family and duplex units and Belvoir Village as the larger senior officer housing. Pre-dating Fort Belvoir is a group of one-story frame houses which were built in 1920-21 as a part of Camp Humphreys. These houses, built as temporary units, originally formed a continuous row stretching from the entrance to Rossell Village on 21st Street, around Jadwin Loop, and continuing across the fort to finish as a neighborhood known as Park Village. In 1939, the frame houses along one side of the central green in Jadwin Loop Village were replaced with a group of five-plex style row houses consistent with the colonial revival character of the Fort. Some of the early frame houses currently remain along 21st Street, along a portion of Jadwin Loop and at Park Village. Others have been removed over the years for various developments at the post. All of these houses, along with the 1939 Jadwin Loop row houses, have recently been added to the list of contributing buildings in the district through the Section 110 process of the National Historic Preservation Act (NHPA). Rossell Village, which is located between Belvoir Village and Jadwin Loop, has also been recently identified as contributing to the historic district. This Village consists of 30 two-story brick duplex buildings built in the late 1940's.

The general approach toward utilizing the historic housing resources at Fort Belvoir is to retain the units in Gerber, Belvoir, Park and Jadwin Loop Villages that contribute to the original colonial revival character of the 1930's development of the post. This was the primary development period of the historic district, and any development within these neighborhoods will be undertaken so as to retain the colonial revival character of the Villages. These units will require interior rehabilitation, repair and upgrading, primarily with respect to mechanical, electrical and plumbing systems, the energy envelope, kitchens, bathrooms and closets. Primary public spaces will remain. The smaller Gerber Village houses will be enlarged. New, detached, two-car garages will be added to all units in Gerber, Belvoir and Jadwin Loop Villages which are presently without them, providing both covered parking and storage. Other exterior rehabilitation work will include maintenance on painted surfaces, roofs, masonry and windows, with possible replacement of some windows. Landscaping will be maintained and upgraded on an ongoing basis, consistent with the historic landscape of the Villages. In Gerber and Belvoir Villages, new infill housing units will be constructed on available home sites, maintaining the original spacing, siting and character of each Village. The infill houses will be designed specifically to be compatible with the historic houses in the Village, utilizing similar style, massing and materials, but readily identifiable as different from the historic units. In Jadwin Loop Village, the 1920's frame houses will be removed, and new row houses of a similar scale and style to those built in 1939 will be constructed, thereby completing the reconstruction of Jadwin Loop started in the 1930's. The placement of the road will be changed slightly, to allow the new buildings to be placed farther from the edge of the cliff.

Between Jadwin Loop Village and Rossell Village, the intact row of six 1920 craftsman style frame houses will be retained and rehabilitated. In Park Village two "L" shaped frame houses from the same period will be retained and rehabilitated. All of the frame houses that are retained will have rehabilitation work done to the exterior that is in keeping with the historic character of the units. All existing original details will be retained or replaced in kind if in deteriorated condition, and an effort will be made to restore important details that have been lost over the years. The houses will be enlarged and similar rehabilitation work to that described above will be undertaken. In Park Village, new housing in a compatible craftsman or bungalow style will be constructed, evocative of the 1920's era, pre-Fort Belvoir, Camp Humphreys. The street will be extended into a loop, similar to other Villages in Fort Belvoir.

The placement of additions, infill housing and garages will be coordinated with the Village site plan and reviewed with the Virginia State Historic Preservation Officer, through the Section 106 process of the NHPA to ensure that the character of each Village is not materially adversely affected by the change. In each case, new housing will be designed to be compatible with the scale and siting of the existing historic houses. These new units will also be sympathetic to the materials and style of their historic neighbors, but will not be imitative of them so that a distinction between the new and historic units may be made.

8.0 ANCILLARY SUPPORT FACILITIES

8.1 Recreation and Neighborhood Centers

The Recreation Center and Neighborhood Centers will provide significant community-building amenities. Within each of our high-tech Neighborhood Centers, we will provide a computer lab and business center equipped with state of the art computer systems, printers, and plotters with connections to the World Wide Web. All existing learning activities will be reviewed and monitored as part of an ongoing community activities and endeavor to provide opportunities to fill the gaps that are identified by community forums. All efforts will be to supplement and support, not overlap, the programs of Morale, Welfare and Recreation (MWR) and Child Development Services (CDS).

The state-of-the-art Recreation Center at Fort Belvoir will be modeled after the cutting edge centers being built today on many college campuses. It will include features such as:

- Indoor pool
- Fitness center/weight room
- Aerobics room
- Basketball court
- Racquetball court
- Men's & Women's locker rooms
- Meeting/Activity Rooms

There will be five new Neighborhood Centers at Fort Belvoir. Each Neighborhood Center will include features such as:

- Great room with attached kitchen for meetings/programs
- Breakout / meeting rooms for smaller groups
- Computer learning center
- Property Management Office
- Fitness room

In addition to these facilities that will have a strong visual identity and presence in each village, the social connections will be provided as well as programs that will teach and foster health and wellness to each resident.

8.2 Welcome Center

The state-of-the-art Welcome Center at Fort Belvoir will be modeled after the cutting edge centers being built today in many new home communities. It will include features such as:

- Residential Welcome Staff offices on the 1st floor to greet every new Fort Belvoir family.
- Meeting Rooms
- Multi-Purpose facility with attached kitchen
- Offices for Development, Construction and Property Management

8.3 Property Management and Construction Space

Property Management

Clark Pinnacle will operate its property management and operations plan in 60,000 square feet of space. We anticipate using 40,000 square feet of indoor space and 20,000 square feet of outdoor space. The specific areas and buildings are shown on the Environmental Assessment (EA) Map dated March 26, 2003.

Construction

The site adjacent to the RCI building (#766) is approximately 3.5 acres (450' x 325'). This area will be used for Clark Realty Builder's (CRB) trailer compound, which will include project management, field supervision, and subcontractor trailers. This area may also house CRB's panel operation/lumber yard.

The site labeled "TB1" is approximately 4 acres (250' x 775'). This is the first site located on the right side of Warren Road. This site will be used for the crushing operation and possibly a concrete batch plant.

The site labeled "TB2" is approximately 4 acres (250' x 775'). This is the first site located on the left side of Warren Road. This site will be used for large equipment storage.

Conclusion

The Residential Communities Initiative offers an incredible opportunity to improve the quality of life of service members and their families. By working together in partnership, the Army, and Fort Belvoir Residential Communities are focused on an integrated plan which provides for a sustainable development throughout the agreed upon term. This integrated approach works best towards enhancing the living environment, resulting in a direct benefit to all who live on the post.

Appendix B
Air Quality Calculations and Record of Non-Applicability

Record of Non-Applicability (RONA)
Concerning the General Conformity Rule (40 CFR Part 51)

Congress enacted Section 2801 of the 1996 Defense authorization Act (Public Law 104-106)(codified at 10 U.S.C. 2871-85). The new law, known as the Military Housing Privatization Initiative, gives the Army alternative authorities for improvement and construction of military family housing allowing the Army to obtain private sector funding to satisfy family housing requirements.

Fort Belvoir proposes to remedy its family housing deficiencies by privatizing its family housing functions through implementation of the Army Residential Communities Initiative (RCI). Under its proposal, the Fort Belvoir command would form a limited liability corporation with a private developer to demolish approximately 1,630 units, construct approximately 1,630 new units, rehabilitate approximately 170 historic units, and maintain 270 recently renovated units in Dogue Creek Village, to provide an end state inventory of about 2,070 units. The limited liability corporation would also operate and maintain Fort Belvoir's family housing units and ancillary supporting facilities (e.g., neighbor hood parks, tot lots, and community centers) for 50 years.

Conformity under the Clean Air Act, Section 176, has been evaluated for the proposed action in accordance with 40 CFR Part 51 and 93. The requirements of this rule are not applicable to this action because the total direct and indirect emissions of nonattainment area pollutants (VOC and NOx) associated with the proposed action would be below the de minimis threshold. Estimated direct and indirect emissions for year with the greatest intensity of work would be 3.37 tons of volatile organic carbons (VOC) and 22.4 tons of nitrogen oxides,. All emissions would fall below the de minimis threshold established at 40 CFR 51.853(b) and 93.153(b)(1) of 25 tons per year of ozone precursors (VOCs and nitrogen oxides).

LTC Kevin Tate, Director
Public Works and Logistics (DPW-L), Fort Belvoir

9 JUL 03

Date

Heating Units

The proposed action involves the installation or replacement of natural gas heating units in each of the 1,630 new homes and 170 historic homes to be rehabilitated, the new Welcome Center, new Recreation Center, and five new Village Centers.

Data on use of natural gas were not available for each piece of equipment. Therefore, use of natural gas for each class of heating unit was estimated according to the unit's percentage of the total rated heat input for all heating units at the base. Detailed calculations of emissions from heating units and water heaters are presented in the Tables B-1 through B-8a.

Emission factors were applied directly to the estimated annual consumption of natural gas to calculate actual emissions of criteria pollutants and PM-2.5 from heating units and water heaters. Emission factors were obtained from AP-42, subsection 1.4, Tables 1.4-1 to 1.4-2. Per AP-42, all particulate matter was assumed to be less than 1.0 micrometer in diameter (ie. the emission factor applies to PM-10 and PM-2.5). As an example, the following equation was used to calculate actual CO emissions from the heating units in Table B-1:

$$\frac{0.273 \text{ MM } cf}{yr} \times \frac{40 \text{ } lb \text{ } CO}{MM \text{ } cf} = 10.9 \text{ } lb \text{ } CO/yr$$

For calculating potential emissions of criteria pollutants, the same emission factors used to calculate actual emissions were directly applied to the hourly consumption of natural gas and multiplied by 8,760 hours per year, which is equivalent to operating 24 hours per day, 365 days per year. For example, the following equation was used to calculate potential CO emissions:

$$\frac{400 \text{ } cf}{hr} \times \frac{\text{MM } cf}{1.0E6 \text{ } cf} \text{ x } \frac{40 \text{ } lb \text{ } CO}{MM \text{ } cf} \text{ x } \frac{8{,}760 \text{ } hr}{yr} = 140 \text{ } lb \text{ } CO/yr = 0.005 \text{ } ton/yr$$

Construction Activities

Construction of the new housing units will involve equipment mobilization, site preparation, demolition, and construction of the housing units. The activities will involve the following operations of 1) on-site construction equipment 2) stone crushing operations, 3) woodworking, 4) concrete batch plant, and 5) motor vehicles including construction material delivery trucks, construction equipment, and workers commuting vehicles. The emissions of these activities were calculated separately and then added together for comparison on an annual basis.

The bulk of the emissions from the proposed action are due to actual construction activities. By phasing these emissions over the 8-year construction period, the emissions have been reduced below 25 tpy for General Conformity requirements.

Stone Crushing Operations and Emissions

The proposed action would involve the operation of a stone crusher located at a temporary construction site. The facility would be used during onsite demolition, in order to crush the reusable material (concrete home slabs, driveways, brick veneer, curbs and sidewalks) into

products for reuse during construction. The crushed product would then be used as structural fill, backfill for utility and plumbing trenches, and new road or slab sub base. Detailed calculations of emissions from stone crushing operations are presented in Table B-9.

The actual emissions from stone crushing operations have been calculated by applying an emission factor to the process rate, or activity factor, and multiplying by the number of hours unit operates in a year. The emission factor is from AP-42, Section 11.19, Tables 11.19.2-2, Emission Factors for Crushed Stone Operation Processes. The total PM-10 emissions are calculated as follows:

$$0.00059 \frac{lb}{ton} \times 100 \frac{ton}{hr} \times \frac{252\ hr}{yr} \times \frac{ton}{2000\ lb} = 0.007\ ton/yr$$

Potential emissions are based on the total amount of stone crushing dust generated multiplied by a factor that represents the increase required for full operation of 8,760 hours / year, divided by 4,056 hr / yr- amount of work hours in a year, under the proposed action construction schedule. The total PM-10 emissions are calculated as follows:

$$\frac{(0.007\ ton)}{yr} \times \frac{8{,}760\ hrs}{4{,}056\ hrs} = 0.016\ tons\ PM\text{-}10/yr$$

Woodworking Operations and Emissions

Woodworking operations under the proposed action includes the temporary wall panel assembly area. This facility will assemble the wall frames of the new homes by nailing precut pieces of wood together. Cutting will be limited to trimming the precut pieces of lumber to specification and trimming wall sheathing. The actual emissions from woodworking operations have been calculated by using the estimated amount of sawdust collected and the control efficiency of the collection system, which is estimated at 90 percent. Detailed calculations of emissions from woodworking are presented in Table B-10. The total PM-10 emissions are calculated as follows:

$$\text{Actual PM-10 emissions: } \frac{25.7\ lbs\ disposed}{yr} \times \left[\frac{1}{90\%\ efficiency} - 1\right]$$
$$= 0.001\ tons\ PM\text{-}10/yr\ emitted$$

Uncontrolled potential emissions are based on the total amount of woodworking waste generated multiplied by a factor that represents the increase required for full operation of 8,760 hours / year, divided by 4,056 hr / yr- amount of work hours in a year, under the proposed action construction schedule. The total PM-10 emissions are calculated as follows:

$$\frac{(25.7\ ton + 0.001\ ton)}{yr} \times \frac{8{,}760\ hrs}{4{,}056\ hrs} = 0.028\ tons\ PM\text{-}10/yr$$

Concrete Batch Plant Operations and Emissions

The proposed action would involve the operation of a concrete batch plant located at a temporary construction site. The purpose would be for onsite concrete production for new home construction. Detailed calculations of emissions from concrete batch operations are presented in Table B-11.

The actual emissions from the concrete batch operation are split into three processes: unloading, weigh hopper loading, and mixer loading. Emissions from vehicle traffic have been accounted for in the off-road vehicle emissions. For unloading processes, emissions have been calculated by applying an emission factor to the process rate of the material unloaded. Emission factors are obtained from AP-42, Table 11.12-2 for Concrete Batching. The total PM-10 emissions are calculated as follows:

$$2{,}295\ \frac{ton}{yr} \times 0.0033\ \frac{lb}{ton\ agg.} + 1{,}757\ \frac{ton}{yr} \times 9.9E\text{-}04\ \frac{lb}{ton\ sand} + 607\ \frac{ton}{yr} \times 9.9E\text{-}04\ \frac{lb}{ton\ cement} = 0.005\ ton/yr$$

For weigh hopper loading processes, emissions have been calculated by applying an emission factor to the process rate of the material unloaded and efficiency of the unit. Emission factors are obtained from AP-42, Table 11.12-2 for Concrete Batching. The total PM-10 emissions are calculated as follows:

$$(2{,}295 + 1{,}757 + 607)\ \frac{ton}{yr\ of\ material} \times 0.0024\ \frac{lb}{ton\ material} \times (1 - 98\%) \div 2000\ \frac{lb}{ton} = 1.12E\text{-}04\ ton/yr$$

For mixer loading processes, emissions have been calculated by applying an emission factor to the process rate of the material unloaded. Emission factors are obtained from AP-42, Table 11.12-2 for Concrete Batching. The total PM-10 emissions are calculated as follows:

$$(2{,}295 + 1{,}757 + 607)\ \frac{ton}{yr\ of\ material} \times 0.011\ \frac{lb}{ton\ material} \div 2000\ \frac{lb}{ton} = 0.026\ ton/yr$$

Potential emissions are calculated by multiplying the actual emissions by a factor that represents the increase required for full operation of 8,760 hours / year, divided by 4,056 hr / yr- standard amount of work hours in a year, as planned by the construction work schedule.

Construction Equipment Operations and Emissions

Construction vehicle operations at Fort Belvoir under the proposed action consist of both on-road privately owned vehicles (POVs) and off-road vehicles or equipment, such as forklifts, loaders, and backhoes. Detailed calculations of emissions from vehicle operations are presented in Tables B-12 through B-27.

Emissions were calculated only for the estimated miles and hours of on-base vehicle and equipment operation. Miles traveled off the base were not included in the emission calculations. The Fifth Edition of AP-42 Volume II includes the emission factors for NOx,

CO, and VOC, which were calculated using EPA's MOBILE 5 model. AP-42 has not been updated with the emission factors from the latest version of EPA's MOBILE 6, released in January 2002. Therefore, the emission factors for on-road vehicles were obtained by running the MOBILE 6 model. The emission factors for PM-10, PM-2.5, and SO_2 were obtained from EPA's PART 5 model. Emission factors for off-road vehicles and equipment were also obtained from EPA's Draft June 2000 Nonroad model. The Draft June 2000 Nonroad model incorporates research results from NEVES, November 1991, as well as from the California off-road model, test results, and regulatory emission standards.

On-Road Vehicle Operations and Emissions

Emission estimates for privately-owned vehicles (POVs) are based on data supplied by Clark Pinnacle Family Communities, LLC (the entity selected as the Army's RCI partner at Fort Belvoir). The daily construction worker POVs and the weekend construction worker POVs were separately grouped into eight vehicle categories by applying an average on-road vehicle mix given in AP-42, Volume II. The annual on-base mileage for each vehicle category under the daily and weekend construction worker POVs was calculated by multiplying the corresponding total on-road mileage with a ratio of the POVs in that vehicle category to the total POVs. Emissions of NOx, CO, and VOC from daily construction worker POVs and weekend construction worker POVs were estimated by multiplying the annual on-base mileage of each vehicle category with the emission factors obtained from MOBILE 6 model runs. The emission factors for PM-10, PM-2.5, and SO_2 were obtained from EPA's PART5 model. Since the model years of POVs traveling on the base most likely range from 1980 to 2002, it is impractical to estimate the emissions from each vehicle in that model year range. Therefore, an estimate of a single average model year for the POVs was selected, based on the methodology presented in AP-42, Volume II. The year 1997 was considered the average vehicle model year, and the emission factors for the 1997 model year vehicles were used.

Emissions were calculated only for the estimated miles and hours of on-base vehicle and equipment operation. Miles traveled off the base were not included in the emission calculations. Emission factors for NOx, CO, and VOC were obtained by running EPA's MOBILE 6 model. Emission factors for PM-10, PM-2.5, and SO_2 were obtained from EPA's PART 5 model. These factors were used in the following equation to estimate annual emissions:

$$E = VFC$$

where:

E = annual emissions of particular pollutant from each vehicle category (lb/yr)
V = vehicle miles traveled on-base per year for each vehicle category (mi/yr)
F = average model year emission factor in the applicable vehicle category (g/mi)
C = conversion factor (2.205×10^{-3} lb/g)

Based on EPA guidance, an average model year for each vehicle category was selected. Emission estimates for privately-owned vehicles (POVs) are based on personnel data supplied by Clark Pinnacle Family Communities. The maximum number of construction

workers for the proposed project is approximately 400 people who will work a schedule of 60 hours per week. In addition, these personnel will be on the base on weekends (Saturday and Sunday) for 9 hours a day. On the basis of the estimated average distance from the front gate of the base to the parking lots, the estimated miles traveled per vehicle is 4.0 miles / day.

Off-Road Vehicle Operations and Emissions

The number and type of equipment necessary for construction activities were first estimated based on the development partner's past experience on similar projects. All equipment was assumed to be diesel-powered. The yearly operating hours were provided by Clark Pinnacle Family Communities. Pieces of equipment to be used for construction of the housing units, new roads, and associated structures include, but are not limited to :

- Loaders
- Dozers
- Pavers
- Pans
- Backhoes
- Rollers
- Motor Graders

Emissions from mobile sources were estimated for off-road vehicles and equipment, such as forklifts, loaders, and backhoes. Criteria pollutant emission factors were obtained from EPA's Draft June 2000 Nonroad model and EPA's *Exhaust Emission Factor for Nonroad Engine Modeling-Compression-Ignition*, Report No. NR-009A, Revised June 1998. These factors, along with the number of vehicles, load factors, hours of operations, and model year were used to estimate the emissions from off-road vehicles and equipment.

Appendix B-1
2004 Projected Emission Calculations for Natural Gas Residential Heating Units
Fort Belvoir, Virginia

Revision: 6
Date: 4/22/02

1.0 Data Required to Calculate Emissions for Natural Gas Residential Furnaces (< 0.3 and 0.3-100 MMBtu/hr)

Are there any of these sources at the facility (1 = YES, 0 = NO)? 1

Location (Building)	Rated Heat Input (BTU/hr)	Number at Location	Total Heat Input (MMBtu/hr)
Heating Units < 0.3 MMBtu/hr			
Welcome Ctr. Furnace	100,000	4	0.40
Total, All Heating Units			**0.40**
Total, Heating Units < 0.3 mmBTU/hr			**0.40**

2.0 Fuel usage at facility.

Projected Natural Gas Use for 2004: 273,000 ft^3

Heat content of fuel - 1,000 BTU/ft^3

3.0 Calculation of Fuel Usage for Furnaces and Water Heaters < 0.3 mmBTU/hr

3.1 Annual Fuel Usage

Annual fuel usage based on heating unit size is used to calculate fuel usage by this size class (< 0.3 MMBtu/hr)

Annual fuel usage = Total heat input of this class (mmBTU/hr) ÷ Total heat input for all heating units (MMBtu/hr) x Total fuel used (cf/yr)

Annual fuel usage = 273,000 ft^3/yr

3.2 Hourly PTE Fuel Usage

Hourly potential to emit fuel usage is based on all furnaces and water heaters running at the same time

Total heat input, this class = 0.40 MMBtu/hr

Fuel usage = 400 ft^3/hr

Fuel usage = Total heat input, this class (MMBtu/hr) ÷ fuel heat content (BTU/ft^3) x 10^6 BTU/MMBtu

Appendix B-1
2004 Projected Emission Calculations for Natural Gas Residential Heating Units
Fort Belvoir, Virginia

4.0 Emission factors, from AP-42, Section 1.4 Tables 1.4-1 and 1.4-2, Residential Furnaces

Constituent	Emission Factors for Heating Units < 0.3 mmBTU/hr
CO	40 lb/1,000,000 ft^3
NOx	94 lb/1,000,000 ft^3
PM-10	7.6 lb/1,000,000 ft^3, condensible and filterable
PM-2.5	7.6 lb/1,000,000 ft^3, condensible and filterable
SO_2	0.6 lb/1,000,000 ft^3
VOC, non-methane	5.5 lb/1,000,000 ft^3
(1) If the combustion source is controlled, the uncontrolled emission factors would be multiplied by the efficiency of the control device, or (1-CE).	

5.0 Calculation of Criteria Pollutant Emission Rates.

Constituent	Annual Actual (lb/yr)	Annual Actual (tpy)	Hourly Potential to Emit (lb/hr) (1)	Annual Potential to Emit (lb/yr) (2)	Annual Potential to Emit (tpy) (2)
CO	10.9	0.005	0.016	140	0.070
NOx	25.7	0.013	0.038	329	0.16
PM-10	2.07	1.04E-03	0.003	26.6	0.013
PM-2.5	2.07	1.04E-03	0.003	26.6	0.013
SO_2	0.16	8.19E-05	2.40E-04	2.10	0.001
VOC	1.50	7.51E-04	0.002	19.3	0.010
(1) Hourly potential to emit fuel usage is based on all heating units running at the same time. (2) Annual potential to emit is based on 8,760 hr/yr.					

5.1 Calculation of Annual Emissions

([Emission Factor (lb/mmcf) x Fuel Usage (cf/yr)] $_{<0.3\ mmBtu/hr}$ + [Emission Factor (lb/mmcf) x Fuel Usage (cf/yr)] $_{0.3\text{-}100\ mmBtu/hr}$) / 10^6 cf/mmcf = Actual Em

5.2 Calculation of Hourly PTE

([Emission Factor (lb/mmcf) x Fuel Usage (cf/hr)]$_{<0.3\ mmBtu/hr}$ + [Emission Factor (lb/mmcf) x Fuel Usage (cf/hr)]$_{0.3\text{-}100\ mmBtu/hr}$) / 10^6 cf/mmcf = Emissions

5.3 Calculation of Annual PTE

Hourly PTE (lb/hr) x 8760 hr/yr = Potential Emissions (lb/yr)

Appendix B-2
2005 Emission Calculations for Removed Natural Gas Residential Heating Units
Fort Belvoir, Virginia

1.0 Data Required to Calculate Emissions for Natural Gas Residential Furnaces (< 0.3 and 0.3-100 MMBtu/hr)

Are there any of these sources at the facility (1 = YES, 0 = NO)? 1

Location (Building)	Rated Heat Input (BTU/hr)	Number at Location	Total Heat Input (MMBtu/hr)
Heating Units < 0.3 MMBtu/hr			
Housing Furnaces	1.00	715	0.001
Housing Water Heaters	1.00	715	0.001
Total, All Heating Units			**0.001**
Total, Heating Units < 0.3 mmBTU/hr			**0.001**

Note: As there is only one class of heating units, actual emissions are based on the emission factor and natural gas use. Therefore, the rated heat input has been assigned a default value of 1, as the existing rated heat input is not known. Changing the rated heat input will not affect the actual emissions.

2.0 Fuel usage at facility.

Based on Natural Gas Use for 2005: 27,618,836 ft^3

Heat content of fuel - 1,000 BTU/ft^3

3.0 Calculation of Fuel Usage for Furnaces and Water Heaters < 0.3 mmBTU/hr

3.1 Annual Fuel Usage

Annual fuel usage based on heating unit size is used to calculate fuel usage by this size class (< 0.3 MMBtu/hr)

Annual fuel usage = Total heat input of this class (mmBTU/hr) ÷ Total heat input for all heating units (MMBtu/hr) x Total fuel used (cf/yr)

Annual fuel usage = 27,618,836 ft^3/yr

4.0

Emission factors, from AP-42, Section 1.4 Tables 1.4-1 and 1.4-2, Residential Furnaces

Constituent	Emission Factors for Heating Units < 0.3 mmBTU/hr
CO	40 lb/1,000,000 ft^3
NOx	94 lb/1,000,000 ft^3
PM-10	7.6 lb/1,000,000 ft^3, condensible and filterable
PM-2.5	7.6 lb/1,000,000 ft^3, condensible and filterable
SO_2	0.6 lb/1,000,000 ft^3
VOC, non-methane	5.5 lb/1,000,000 ft^3
If the combustion source is controlled, the uncontrolled emission factors would be multiplied by the efficiency of the control device, or (1-CE).	

5.0 Calculation of Criteria Pollutant Emission Rates.

Constituent	Annual Actual (lb/yr)	Annual Actual (tpy)
CO	1,105	0.55
NOx	2,596	1.30
PM-10	210	0.10
PM-2.5	210	0.10
SO_2	16.6	0.008
VOC	152	0.076

5.1 Calculation of Annual Emissions

([Emission Factor (lb/mmcf) x Fuel Usage (cf/yr)] $_{<0.3\ mmBtu/hr}$ + [Emission Factor (lb/mmcf) x Fuel Usage (cf/yr)] $_{0.3\text{-}100\ mmBtu/hr}$) / 10^6 cf/mmcf = Actual Emiss

Revision: 5
Date: 5/25/01

Table B-2a
Emission Calculations for
Removed Heating Oil
Heating Units
Fort Belvoir, Virginia

1.0 Initial data needed for emission calculations for commercial heating units fired with diesel fuel or heating oil (< 100 MMBtu/hr)

Are any heating units < 100 MMBtu/hr fired with heating oil or diesel fuel (1=YES, 0=NO) 1

Location (Bldg)	Rated Heat Input (MMBtu/hr)	Number at Location	Total Heat Input (MMBtu/hr)
Rossell	1.00	60	60.0
Total, All Heating Units			**60.0**

Note: As there is only one class of heating units, actual emissions are based on the emission factor and heating oil use. Therefore, the rated heat input has been assigned a default value of 1, as the existing rated heat input is not known. Changing the rated heat input will not affect the actual emissions.

Heating Oil used during 2005	45,970	gal
Heat content of fuel -	139,600	BTU/gal
Sulfur content of fuel -	0.30	wt%

2.0 Emission factors, from AP-42, Section 1.3 Tables 1.3-1, 1.3-2, 1.3-7 Commercial/Institutional/ Residential Heating Units (9/98)

Constituent	Emission Factor
CO	5 lb/1000 gal fuel
NOx	20 lb/1000 gal fuel
PM-10 (1)	2.38 lb/1000 gal fuel
PM-2.5 (1)	2.13 lb/1000 gal fuel
SO_2	42.6 lb/1000 gal fuel
VOC, non-methane	0.34 lb/1000 gal fuel

(1) If the combustion source is controlled, the uncontrolled emission factors would be multiplied by the efficiency of the control device, or (1-CE).

3.0 Calculation of Criteria Pollutant Emission Rates.

Constituent	Annual Actual (lb/yr)	Annual Actual (tpy)
CO	230	0.11
NOx	919	0.46
PM-10	109	0.055
PM-2.5	97.9	0.049
SO_2	1,958	0.98
VOC	15.6	0.008

3.1 Calculation of Annual Emissions

Emission Factor (lb/1000 gal) x Fuel Usage (gal/yr) = Actual Emissions (lb/yr)

Appendix B-2b
2005 Projected Emission Calculations for Natural Gas Residential Heating Units
Fort Belvoir, Virginia

1.0 Data Required to Calculate Emissions for Natural Gas Residential Furnaces (< 0.3 and 0.3-100 MMBtu/hr)

Are there any of these sources at the facility (1 = YES, 0 = NO)? 1

Location (Building)	Rated Heat Input (BTU/hr)	Number at Location	Total Heat Input (MMBtu/hr)
Heating Units < 0.3 MMBtu/hr			
Housing Furnaces	78,000	350	27.3
Housing Water Heaters	44,240	350	15.5
Rec Ctr. Furnace	100,000	8	0.80
New South Post Village Ctr. Furnace	100,000	3.0	0.30
Total, All Heating Units			**43.9**
Total, Heating Units < 0.3 mmBTU/hr			**43.9**

2.0 Fuel usage at facility.

Projected Natural Gas Use for 2005: 90,684,500 ft^3

Heat content of fuel - 1,000 BTU/ft^3

3.0 Calculation of Fuel Usage for Furnaces and Water Heaters < 0.3 mmBTU/hr

3.1 Annual Fuel Usage

Annual fuel usage based on heating unit size is used to calculate fuel usage by this size class (< 0.3 MMBtu/hr)

Annual fuel usage = Total heat input of this class (mmBTU/hr) ÷ Total heat input for all heating units (MMBtu/hr) x Total fuel used (cf/yr)

Annual fuel usage = 90,684,500 ft^3/yr

3.2 Hourly PTE Fuel Usage

Hourly potential to emit fuel usage is based on all furnaces and water heaters running at the same time

Total heat input, this class = 43.88 MMBtu/hr

Fuel usage = 43,884 ft^3/hr

Fuel usage = Total heat input, this class (MMBtu/hr) ÷ fuel heat content (BTU/ft^3) x 10^6 BTU/MMBtu

4.0

Emission factors, from AP-42, Section 1.4 Tables 1.4-1 and 1.4-2, Residential Furnaces

Constituent	Emission Factors for Heating Units < 0.3 mmBTU/hr
CO	40 lb/1,000,000 ft^3
NOx	94 lb/1,000,000 ft^3
PM-10	7.6 lb/1,000,000 ft^3, condensible and filterable
PM-2.5	7.6 lb/1,000,000 ft^3, condensible and filterable
SO_2	0.6 lb/1,000,000 ft^3
VOC, non-methane	5.5 lb/1,000,000 ft^3
(1) If the combustion source is controlled, the uncontrolled emission factors would be multiplied by the efficiency of the control device, or (1-CE).	

Appendix B-2b
2005 Projected Emission Calculations for Natural Gas Residential Heating Units
Fort Belvoir, Virginia

5.0 Calculation of Criteria Pollutant Emission Rates.

Constituent	Annual Actual (lb/yr)	Annual Actual (tpy)	Hourly Potential to Emit (lb/hr) (1)	Annual Potential to Emit (lb/yr) (2)	Annual Potential to Emit (tpy) (2)
CO	#REF!	#REF!	#REF!	#REF!	#REF!
NOx	#REF!	#REF!	#REF!	#REF!	#REF!
PM-10	#REF!	#REF!	#REF!	#REF!	#REF!
PM-2.5	#REF!	#REF!	#REF!	#REF!	#REF!
SO_2	#REF!	#REF!	#REF!	#REF!	#REF!
VOC	#REF!	#REF!	#REF!	#REF!	#REF!

(1) Hourly potential to emit fuel usage is based on all heating units running at the same time.
(2) Annual potential to emit is based on 8,760 hr/yr.

5.1 Calculation of Annual Emissions

([Emission Factor (lb/mmcf) x Fuel Usage (cf/yr)] $_{<0.3\ mmBtu/hr}$ + [Emission Factor (lb/mmcf) x Fuel Usage (cf/yr)] $_{0.3\text{-}100\ mmBtu/hr}$) / 10^6 cf/mmcf = Actual Emiss

5.2 Calculation of Hourly PTE

([Emission Factor (lb/mmcf) x Fuel Usage (cf/hr)]$_{<0.3\ mmBtu/hr}$ + [Emission Factor (lb/mmcf) x Fuel Usage (cf/hr)]$_{0.3\text{-}100\ mmBtu/hr}$) / 10^6 cf/mmcf = Emissions (lb

5.3 Calculation of Annual PTE

Hourly PTE (lb/hr) x 8760 hr/yr = Potential Emissions (lb/yr)

Appendix B-3
Emission Calculations for 2006 Removed Natural Gas Residential Heating Units
Fort Belvoir, Virginia

1.0 Data Required to Calculate Emissions for Natural Gas Residential Furnaces (< 0.3 and 0.3-100 MMBtu/hr)

Are there any of these sources at the facility (1 = YES, 0 = NO)? 1

Location (Building)	Rated Heat Input (BTU/hr)	Number at Location	Total Heat Input (MMBtu/hr)
Heating Units < 0.3 MMBtu/hr			
Housing Furnaces	1	298	2.98E-04
Housing Water Heaters	1	298	2.98E-04
Total, All Heating Units			**0.001**
Total, Heating Units < 0.3 mmBTU/hr			**0.001**

Note: As there is only one class of heating units, actual emissions are based on the emission factor and natural gas use. Therefore, the rated heat input has been assigned a default value of 1, as the existing rated heat input is not known. Changing the rated heat input will not affect the actual emissions.

2.0 Fuel usage at facility.

Based on Natural Gas Use for 2006: 3,170,836 ft^3

Heat content of fuel - 1,000 BTU/ft^3

3.0 Calculation of Fuel Usage for Furnaces and Water Heaters < 0.3 mmBTU/hr

3.1 Annual Fuel Usage

Annual fuel usage based on heating unit size is used to calculate fuel usage by this size class (< 0.3 MMBtu/hr)

Annual fuel usage = Total heat input of this class (mmBTU/hr) ÷ Total heat input for all heating units (MMBtu/hr) x Total fuel used (cf/yr)

Annual fuel usage = 3,170,836 ft^3/yr

4.0

Emission factors, from AP-42, Section 1.4 Tables 1.4-1 and 1.4-2, Residential Furnaces

Constituent	Emission Factors for Heating Units < 0.3 mmBTU/hr
CO	40 lb/1,000,000 ft^3
NOx	94 lb/1,000,000 ft^3
PM-10	7.6 lb/1,000,000 ft^3, condensible and filterable
PM-2.5	7.6 lb/1,000,000 ft^3, condensible and filterable
SO_2	0.6 lb/1,000,000 ft^3
VOC, non-methane	5.5 lb/1,000,000 ft^3
(1) If the combustion source is controlled, the uncontrolled emission factors would be multiplied by the efficiency of the control device, or (1-CE).	

5.0 Calculation of Criteria Pollutant Emission Rates.

Constituent	Annual Actual (lb/yr)	Annual Actual (tpy)
CO	127	0.063
NOx	298	0.15
PM-10	24.1	0.012
PM-2.5	24.1	0.012
SO_2	1.90	0.001
VOC	17.4	0.009

5.1 Calculation of Annual Emissions

([Emission Factor (lb/mmcf) x Fuel Usage (cf/yr)] $_{<0.3\ mmBtu/hr}$ + [Emission Factor (lb/mmcf) x Fuel Usage (cf/yr)] $_{0.3\text{-}100\ mmBtu/hr}$) / 10^6 cf/mmcf = Actual Emissions (lb/yr)

Appendix B-3a
2006 Projected Emission Calculations for Natural Gas Residential Heating Units
Fort Belvoir, Virginia

1.0 Data Required to Calculate Emissions for Natural Gas Residential Furnaces (< 0.3 and 0.3-100 MMBtu/hr)

Are there any of these sources at the facility (1 = YES, 0 = NO)? 1

Location (Building)	Rated Heat Input (BTU/hr)	Number at Location	Total Heat Input (MMBtu/hr)
Heating Units < 0.3 MMBtu/hr			
Housing Furnaces	78,000	401	31.3
Housing Water Heaters	44,240	401	17.7
Lewis Heights Village Ctr. Furnace	100,000	3	0.30
Total, All Heating Units			**49.3**
Total, Heating Units < 0.3 mmBTU/hr			**49.3**

2.0 Fuel usage at facility.

Projected Natural Gas Use for 2006: 102,717,850 ft^3

Heat content of fuel - 1,000 BTU/ft^3

3.0 Calculation of Fuel Usage for Furnaces and Water Heaters < 0.3 mmBTU/hr

3.1 Annual Fuel Usage

Annual fuel usage based on heating unit size is used to calculate fuel usage by this size class (< 0.3 MMBtu/hr)

Annual fuel usage = Total heat input of this class (mmBTU/hr) ÷ Total heat input for all heating units (MMBtu/hr) x Total fuel used (cf/yr)

Annual fuel usage = 102,717,850 ft^3/yr

3.2 Hourly PTE Fuel Usage

Hourly potential to emit fuel usage is based on all furnaces and water heaters running at the same time

Total heat input, this class = 49.32 MMBtu/hr

Fuel usage = 49,318 ft^3/hr

Fuel usage = Total heat input, this class (MMBtu/hr) ÷ fuel heat content (BTU/ft^3) x 10^6 BTU/MMBtu

4.0

Emission factors, from AP-42, Section 1.4 Tables 1.4-1 and 1.4-2, Residential Furnaces

Constituent	Emission Factors for Heating Units < 0.3 mmBTU/hr
CO	40 lb/1,000,000 ft^3
NOx	94 lb/1,000,000 ft^3
PM-10	7.6 lb/1,000,000 ft^3, condensible and filterable
PM-2.5	7.6 lb/1,000,000 ft^3, condensible and filterable
SO_2	0.6 lb/1,000,000 ft^3
VOC, non-methane	5.5 lb/1,000,000 ft^3
(1) If the combustion source is controlled, the uncontrolled emission factors would be multiplied by the efficiency of the control device, or (1-CE).	

Appendix B-3a
2006 Projected Emission Calculations for Natural Gas Residential Heating Units
Fort Belvoir, Virginia

5.0 Calculation of Criteria Pollutant Emission Rates.

Constituent	Annual Actual (lb/yr)	Annual Actual (tpy)	Hourly Potential to Emit (lb/hr) (1)	Annual Potential to Emit (lb/yr) (2)	Annual Potential to Emit (tpy) (2)
CO	4,109	2.05	1.97	17,281	8.64
NOx	9,655	4.83	4.64	40,611	20.3
PM-10	781	0.39	0.37	3,283	1.64
PM-2.5	781	0.39	0.37	3,283	1.64
SO_2	61.6	0.031	0.03	259	0.13
VOC	565	0.28	0.27	2,376	1.19
(1) Hourly potential to emit fuel usage is based on all heating units running at the same time.					
(2) Annual potential to emit is based on 8,760 hr/yr.					

5.1 Calculation of Annual Emissions

([Emission Factor (lb/mmcf) x Fuel Usage (cf/yr)] $_{<0.3\ mmBtu/hr}$ + [Emission Factor (lb/mmcf) x Fuel Usage (cf/yr)] $_{0.3\text{-}100\ mmBtu/hr}$) / 10^6 cf/mmcf = Actual Emis

5.2 Calculation of Hourly PTE

([Emission Factor (lb/mmcf) x Fuel Usage (cf/hr)]$_{<0.3\ mmBtu/hr}$ + [Emission Factor (lb/mmcf) x Fuel Usage (cf/hr)]$_{0.3\text{-}100\ mmBtu/hr}$) / 10^6 cf/mmcf = Emissions (l

5.3 Calculation of Annual PTE

Hourly PTE (lb/hr) x 8760 hr/yr = Potential Emissions (lb/yr)

Appendix B-4
Emission Calculations for 2007 Removed Natural Gas Residential Heating Units
Fort Belvoir, Virginia

1.0 Data Required to Calculate Emissions for Natural Gas Residential Furnaces (< 0.3 and 0.3-100 MMBtu/hr)

Are there any of these sources at the facility (1 = YES, 0 = NO)? 1

Location (Building)	Rated Heat Input (BTU/hr)	Number at Location	Total Heat Input (MMBtu/hr)
Heating Units < 0.3 MMBtu/hr			
Housing Furnaces	1	367	3.67E-04
Housing Water Heaters	1	367	3.67E-04
Total, All Heating Units			**0.001**
Total, Heating Units < 0.3 mmBTU/hr			**0.001**

Note: As there is only one class of heating units, actual emissions are based on the emission factor and natural gas use. Therefore, the rated heat input has been assigned a default value of 1, as the existing rated heat input is not known. Changing the rated heat input will not affect the actual emissions.

2.0 Fuel usage at facility.

Based on Natural Gas Use for 2007: 19,688,297 ft^3

Heat content of fuel - 1,000 BTU/ft^3

3.0 Calculation of Fuel Usage for Furnaces and Water Heaters < 0.3 mmBTU/hr

3.1 Annual Fuel Usage

Annual fuel usage based on heating unit size is used to calculate fuel usage by this size class (< 0.3 MMBtu/hr)

Annual fuel usage = Total heat input of this class (mmBTU/hr) ÷ Total heat input for all heating units (MMBtu/hr) x Total fuel used (cf/yr)

Annual fuel usage = 19,688,297 ft^3/yr

4.0

Emission factors, from AP-42, Section 1.4 Tables 1.4-1 and 1.4-2, Residential Furnaces

Constituent	Emission Factors for Heating Units < 0.3 mmBTU/hr
CO	40 lb/1,000,000 ft^3
NOx	94 lb/1,000,000 ft^3
PM-10	7.6 lb/1,000,000 ft^3, condensible and filterable
PM-2.5	7.6 lb/1,000,000 ft^3, condensible and filterable
SO_2	0.6 lb/1,000,000 ft^3
VOC, non-methane	5.5 lb/1,000,000 ft^3
(1) If the combustion source is controlled, the uncontrolled emission factors would be multiplied by the efficiency of the control device, or (1-CE).	

5.0 Calculation of Criteria Pollutant Emission Rates.

Constituent	Annual Actual (lb/yr)	Annual Actual (tpy)
CO	788	0.39
NOx	1,851	0.93
PM-10	150	0.075
PM-2.5	150	0.075
SO_2	11.8	0.006
VOC	108	0.054

5.1 Calculation of Annual Emissions

([Emission Factor (lb/mmcf) x Fuel Usage (cf/yr)] $_{<0.3\ mmBtu/hr}$ + [Emission Factor (lb/mmcf) x Fuel Usage (cf/yr)] $_{0.3\text{-}100\ mmBtu/hr}$) / 10^6 cf/mmcf = Actual Emissions (lb/yr)

Appendix B-5
Emission Calculations for 2008 Removed Natural Gas Residential Heating Units
Fort Belvoir, Virginia

1.0 Data Required to Calculate Emissions for Natural Gas Residential Furnaces (< 0.3 and 0.3-100 MMBtu/hr)

Are there any of these sources at the facility (1 = YES, 0 = NO)? 1

Location (Building)	Rated Heat Input (BTU/hr)	Number at Location	Total Heat Input (MMBtu/hr)
Heating Units < 0.3 MMBtu/hr			
Housing Furnaces	1	162	1.62E-04
Housing Water Heaters	1	162	1.62E-04
Total, All Heating Units			**3.24E-04**
Total, Heating Units < 0.3 mmBTU/hr			**3.24E-04**

Note: As there is only one class of heating units, actual emissions are based on the emission factor and natural gas use. Therefore, the rated heat input has been assigned a default value of 1, as the existing rated heat input is not known. Changing the rated heat input will not affect the actual emissions.

2.0 Fuel usage at facility.

Based on Natural Gas Use for 2002: 12,764,129 ft^3

Heat content of fuel - 1,000 BTU/ft^3

3.0 Calculation of Fuel Usage for Furnaces and Water Heaters < 0.3 mmBTU/hr

3.1 Annual Fuel Usage

Annual fuel usage based on heating unit size is used to calculate fuel usage by this size class (< 0.3 MMBtu/hr)

Annual fuel usage = Total heat input of this class (mmBTU/hr) ÷ Total heat input for all heating units (MMBtu/hr) x Total fuel used (cf/yr)

Annual fuel usage = 12,764,129 ft^3/yr

4.0

Emission factors, from AP-42, Section 1.4 Tables 1.4-1 and 1.4-2, Residential Furnaces

Constituent	Emission Factors for Heating Units < 0.3 mmBTU/hr
CO	40 lb/1,000,000 ft^3
NOx	94 lb/1,000,000 ft^3
PM-10	7.6 lb/1,000,000 ft^3, condensible and filterable
PM-2.5	7.6 lb/1,000,000 ft^3, condensible and filterable
SO_2	0.6 lb/1,000,000 ft^3
VOC, non-methane	5.5 lb/1,000,000 ft^3
(1) If the combustion source is controlled, the uncontrolled emission factors would be multiplied by the efficiency of the control device, or (1-CE).	

5.0 Calculation of Criteria Pollutant Emission Rates.

Constituent	Annual Actual (lb/yr)	Annual Actual (tpy)
CO	511	0.26
NOx	1,200	0.60
PM-10	97.0	0.049
PM-2.5	97.0	0.049
SO_2	7.66	0.004
VOC	70.2	0.035

5.1 Calculation of Annual Emissions

([Emission Factor (lb/mmcf) x Fuel Usage (cf/yr)] $_{<0.3\ mmBtu/hr}$ + [Emission Factor (lb/mmcf) x Fuel Usage (cf/yr)] $_{0.3\text{-}100\ mmBtu/hr}$) / 10^6 cf/mmcf = Actual Emiss

Appendix B-5a
2008 Projected Emission Calculations for Natural Gas Residential Heating Units
Fort Belvoir, Virginia

Revision: 6
Date: 4/22/02

1.0 Data Required to Calculate Emissions for Natural Gas Residential Furnaces (< 0.3 and 0.3-100 MMBtu/hr)

Are there any of these sources at the facility (1 = YES, 0 = NO)? 1

Location (Building)	Rated Heat Input (BTU/hr)	Number at Location	Total Heat Input (MMBtu/hr)
Heating Units < 0.3 MMBtu/hr			
Housing Furnaces	78,000	316	24.6
Housing Water Heaters	44,240	316	14.0
GW Village Ctr. Furnace	100,000	3	0.30
Total, All Heating Units			**38.9**
Total, Heating Units < 0.3 mmBTU/hr			**38.9**

2.0 Fuel usage at facility.

Projected Natural Gas Use for 2008: 80,970,600 ft^3

Heat content of fuel - 1,000 BTU/ft^3

3.0 Calculation of Fuel Usage for Furnaces and Water Heaters < 0.3 mmBTU/hr

3.1 Annual Fuel Usage

Annual fuel usage based on heating unit size is used to calculate fuel usage by this size class (< 0.3 MMBtu/hr)

Annual fuel usage = Total heat input of this class (mmBTU/hr) ÷ Total heat input for all heating units (MMBtu/hr) x Total fuel used (cf/yr)

Annual fuel usage = 80,970,600 ft^3/yr

3.2 Hourly PTE Fuel Usage

Hourly potential to emit fuel usage is based on all furnaces and water heaters running at the same time

Total heat input, this class = 38.93 MMBtu/hr

Fuel usage = 38,928 ft^3/hr

Fuel usage = Total heat input, this class (MMBtu/hr) ÷ fuel heat content (BTU/ft^3) x 10^6 BTU/MMBtu

4.0

Emission factors, from AP-42, Section 1.4 Tables 1.4-1 and 1.4-2, Residential Furnaces

Constituent	Emission Factors for Heating Units < 0.3 mmBTU/hr
CO	40 lb/1,000,000 ft^3
NOx	94 lb/1,000,000 ft^3
PM-10	7.6 lb/1,000,000 ft^3, condensible and filterable
PM-2.5	7.6 lb/1,000,000 ft^3, condensible and filterable
SO_2	0.6 lb/1,000,000 ft^3
VOC, non-methane	5.5 lb/1,000,000 ft^3
(1) If the combustion source is controlled, the uncontrolled emission factors would be multiplied by the efficiency of the control device, or (1-CE).	

Appendix B-5a
2008 Projected Emission Calculations for Natural Gas Residential Heating Units
Fort Belvoir, Virginia

5.0 Calculation of Criteria Pollutant Emission Rates.

Constituent	Annual Actual (lb/yr)	Annual Actual (tpy)	Hourly Potential to Emit (lb/hr) (1)	Annual Potential to Emit (lb/yr) (2)	Annual Potential to Emit (tpy) (2)
CO	3,239	1.62	1.56	13,640	6.82
NOx	7,611	3.81	3.66	32,055	16.0
PM-10	615	0.31	0.30	2,592	1.30
PM-2.5	615	0.31	0.30	2,592	1.30
SO_2	48.6	0.024	0.023	205	0.10
VOC	445	0.223	0.21	1,876	0.94

(1) Hourly potential to emit fuel usage is based on all heating units running at the same time.
(2) Annual potential to emit is based on 8,760 hr/yr.

5.1 Calculation of Annual Emissions

([Emission Factor (lb/mmcf) x Fuel Usage (cf/yr)] $_{<0.3\ mmBtu/hr}$ + [Emission Factor (lb/mmcf) x Fuel Usage (cf/yr)] $_{0.3\text{-}100\ mmBtu/hr}$) / 10^6 cf/mmcf = Actual Emis

5.2 Calculation of Hourly PTE

([Emission Factor (lb/mmcf) x Fuel Usage (cf/hr)]$_{<0.3\ mmBtu/hr}$ + [Emission Factor (lb/mmcf) x Fuel Usage (cf/hr)]$_{0.3\text{-}100\ mmBtu/hr}$) / 10^6 cf/mmcf = Emissions (l

5.3 Calculation of Annual PTE

Hourly PTE (lb/hr) x 8760 hr/yr = Potential Emissions (lb/yr)

Appendix B-6
Emission Calculations for 2009 Removed Natural Gas Residential Heating Units
Fort Belvoir, Virginia

1.0 Data Required to Calculate Emissions for Natural Gas Residential Furnaces (< 0.3 and 0.3-100 MMBtu/hr)

Are there any of these sources at the facility (1 = YES, 0 = NO)? 1

Location (Building)	Rated Heat Input (BTU/hr)	Number at Location	Total Heat Input (MMBtu/hr)
Heating Units < 0.3 MMBtu/hr			
Housing Furnaces	1	63	6.30E-05
Housing Water Heaters	1	63	6.30E-05
Total, All Heating Units			**1.26E-04**
Total, Heating Units < 0.3 mmBTU/hr			**1.26E-04**

Note: As there is only one class of heating units, actual emissions are based on the emission factor and natural gas use. Therefore, the rated heat input has been assigned a default value of 1, as the existing rated heat input is not known. Changing the rated heat input will not affect the actual emissions.

2.0 Fuel usage at facility.

Based on Natural Gas Use for 2009: 4,980,559 ft^3

Heat content of fuel - 1,000 BTU/ft^3

3.0 Calculation of Fuel Usage for Furnaces and Water Heaters < 0.3 mmBTU/hr

3.1 Annual Fuel Usage

Annual fuel usage based on heating unit size is used to calculate fuel usage by this size class (< 0.3 MMBtu/hr)

Annual fuel usage = Total heat input of this class (mmBTU/hr) ÷ Total heat input for all heating units (MMBtu/hr) x Total fuel used (cf/yr)

Annual fuel usage = 4,980,559 ft^3/yr

4.0

Emission factors, from AP-42, Section 1.4 Tables 1.4-1 and 1.4-2, Residential Furnaces

Constituent	Emission Factors for Heating Units < 0.3 mmBTU/hr
CO	40 lb/1,000,000 ft^3
NOx	94 lb/1,000,000 ft^3
PM-10 (1)	7.6 lb/1,000,000 ft^3, condensible and filterable
PM-2.5 (1)	7.6 lb/1,000,000 ft^3, condensible and filterable
SO_2	0.6 lb/1,000,000 ft^3
VOC, non-methane	5.5 lb/1,000,000 ft^3

(1) Combination of both filterable and condensable particulate matter. All particulate matter is assumed to be less than 1.0 micrometer in diameter (ie. the emission factor applies to Total PM, PM-10, and PM-2.5), see AP-42, Table 1.4-2.

(2) If the combustion source is controlled, the uncontrolled emission factors would be multiplied by the efficiency of the control device, or (1-CE).

5.0 Calculation of Criteria Pollutant Emission Rates.

Constituent	Annual Actual (lb/yr)	Annual Actual (tpy)
CO	199	0.10
NOx	468	0.23
PM-10	38	0.02
PM-2.5	38	0.02
SO_2	3.0	0.001
VOC	27	0.01

5.1 Calculation of Annual Emissions

([Emission Factor (lb/mmcf) x Fuel Usage (cf/yr)] <0.3 mmBtu/hr + [Emission Factor (lb/mmcf) x Fuel Usage (cf/yr)] 0.3-100

Appendix B-6a
2009 Projected Emission Calculations for Natural Gas Residential Heating Units
Fort Belvoir, Virginia

Revision: 6
Date: 4/22/02

1.0 Data Required to Calculate Emissions for Natural Gas Residential Furnaces (< 0.3 and 0.3-100 MMBtu/hr)

Are there any of these sources at the facility (1 = YES, 0 = NO)? 1

Location (Building)	Rated Heat Input (BTU/hr)	Number at Location	Total Heat Input (MMBtu/hr)
Heating Units < 0.3 MMBtu/hr			
Housing Furnaces	78,000	109	8.50
Housing Water Heaters	44,240	109	4.82
Fairfax Village Ctr. Furnace	100,000	3	0.30
Total, All Heating Units			**13.6**
Total, Heating Units < 0.3 mmBTU/hr			**13.6**

2.0 Fuel usage at facility.

Projected Natural Gas Use for 2009: 28,009,650 ft^3

Heat content of fuel - 1,000 BTU/ft^3

3.0 Calculation of Fuel Usage for Furnaces and Water Heaters < 0.3 mmBTU/hr

3.1 Annual Fuel Usage

Annual fuel usage based on heating unit size is used to calculate fuel usage by this size class (< 0.3 MMBtu/hr)

Annual fuel usage = Total heat input of this class (mmBTU/hr) ÷ Total heat input for all heating units (MMBtu/hr) x Total fuel used (cf/yr)

Annual fuel usage = 28,009,650 ft^3/yr

3.2 Hourly PTE Fuel Usage

Hourly potential to emit fuel usage is based on all furnaces and water heaters running at the same time

Total heat input, this class = 13.62 MMBtu/hr

Fuel usage = 13,624 ft^3/hr

Fuel usage = Total heat input, this class (MMBtu/hr) ÷ fuel heat content (BTU/ft^3) x 10^6 BTU/MMBtu

4.0

Emission factors, from AP-42, Section 1.4 Tables 1.4-1 and 1.4-2, Residential Furnaces

Constituent	Emission Factors for Heating Units < 0.3 mmBTU/hr
CO	40 lb/1,000,000 ft^3
NOx	94 lb/1,000,000 ft^3
PM-10	7.6 lb/1,000,000 ft^3, condensible and filterable
PM-2.5	7.6 lb/1,000,000 ft^3, condensible and filterable
SO_2	0.6 lb/1,000,000 ft^3
VOC, non-methane	5.5 lb/1,000,000 ft^3
(1) If the combustion source is controlled, the uncontrolled emission factors would be multiplied by the efficiency of the control device, or (1-CE).	

Appendix B-6a
2009 Projected Emission Calculations for Natural Gas Residential Heating Units
Fort Belvoir, Virginia

5.0 Calculation of Criteria Pollutant Emission Rates.

Constituent	Annual Actual (lb/yr)	Annual Actual (tpy)	Hourly Potential to Emit (lb/hr) (1)	Annual Potential to Emit (lb/yr) (2)	Annual Potential to Emit (tpy) (2)
CO	1,120	0.56	0.54	4,774	2.39
NOx	2,633	1.32	1.28	11,219	5.61
PM-10	213	0.11	0.10	907	0.45
PM-2.5	213	0.11	0.10	907	0.45
SO_2	16.8	0.008	0.008	71.6	0.036
VOC	154	0.077	0.075	656	0.33

(1) Hourly potential to emit fuel usage is based on all heating units running at the same time.
(2) Annual potential to emit is based on 8,760 hr/yr.

5.1 Calculation of Annual Emissions

([Emission Factor (lb/mmcf) x Fuel Usage (cf/yr)] $_{<0.3\ mmBtu/hr}$ + [Emission Factor (lb/mmcf) x Fuel Usage (cf/yr)] $_{0.3\text{-}100\ mmBtu/hr}$) / 10^6 cf/mmcf = Actual Emissions (lb/yr)

5.2 Calculation of Hourly PTE

([Emission Factor (lb/mmcf) x Fuel Usage (cf/hr)]$_{<0.3\ mmBtu/hr}$ + [Emission Factor (lb/mmcf) x Fuel Usage (cf/hr)]$_{0.3\text{-}100\ mmBtu/hr}$) / 10^6 cf/mmcf = Emissions (lb/hr)

5.3 Calculation of Annual PTE

Hourly PTE (lb/hr) x 8760 hr/yr = Potential Emissions (lb/yr)

Appendix B-7
Emission Calculations for 2010 Removed Natural Gas Residential Heating Units
Fort Belvoir, Virginia

1.0 Data Required to Calculate Emissions for Natural Gas Residential Furnaces (< 0.3 and 0.3-100 MMBtu/hr)

Are there any of these sources at the facility (1 = YES, 0 = NO)? 1

Location (Building)	Rated Heat Input (BTU/hr)	Number at Location	Total Heat Input (MMBtu/hr)
Heating Units < 0.3 MMBtu/hr			
Housing Furnaces	1	210	2.10E-04
Housing Water Heaters	1	210	2.10E-04
Total, All Heating Units			**4.20E-04**
Total, Heating Units < 0.3 mmBTU/hr			**4.20E-04**

Note: As there is only one class of heating units, actual emissions are based on the emission factor and natural gas use. Therefore, the rated heat input has been assigned a default value of 1, as the existing rated heat input is not known. Changing the rated heat input will not affect the actual emissions.

2.0 Fuel usage at facility.

Based on Natural Gas Use for 2010: 8,472,057 ft^3

Heat content of fuel - 1,000 BTU/ft^3

3.0 Calculation of Fuel Usage for Furnaces and Water Heaters < 0.3 mmBTU/hr

3.1 Annual Fuel Usage

Annual fuel usage based on heating unit size is used to calculate fuel usage by this size class (< 0.3 MMBtu/hr)

Annual fuel usage = Total heat input of this class (mmBTU/hr) ÷ Total heat input for all heating units (MMBtu/hr) x Total fuel used (cf/yr)

Annual fuel usage = 8,472,057 ft^3/yr

4.0

Emission factors, from AP-42, Section 1.4 Tables 1.4-1 and 1.4-2, Residential Furnaces

Constituent	Emission Factors for Heating Units < 0.3 mmBTU/hr
CO	40 lb/1,000,000 ft^3
NOx	94 lb/1,000,000 ft^3
PM-10	7.6 lb/1,000,000 ft^3, condensible and filterable
PM-2.5	7.6 lb/1,000,000 ft^3, condensible and filterable
SO_2	0.6 lb/1,000,000 ft^3
VOC, non-methane	5.5 lb/1,000,000 ft^3
(1) If the combustion source is controlled, the uncontrolled emission factors would be multiplied by the efficiency of the control device, or (1-CE).	

5.0 Calculation of Criteria Pollutant Emission Rates.

Constituent	Annual Actual (lb/yr)	Annual Actual (tpy)
CO	339	0.17
NOx	796	0.40
PM-10	64.4	0.032
PM-2.5	64.4	0.032
SO_2	5.08	0.003
VOC	46.6	0.023

5.1 Calculation of Annual Emissions

([Emission Factor (lb/mmcf) x Fuel Usage (cf/yr)] $_{<0.3\ mmBtu/hr}$ + [Emission Factor (lb/mmcf) x Fuel Usage (cf/yr)] $_{0.3\text{-}100\ mmBtu/hr}$) / 10^6 cf/mmcf = Actual Emissions (lb/yr)

Revision: 5
Date: 5/25/01

Table B-7a
Emission Calculations for
2010 Removed Heating Oil
Heating Units
Fort Belvoir, Virginia

1.0 Initial data needed for emission calculations for commercial heating units fired with diesel fuel or heating oil (< 100 MMBtu/hr)

Are any heating units < 100 MMBtu/hr fired with heating oil or diesel fuel (1=YES, 0=NO) | 1

Location (Bldg)	Rated Heat Input (MMBtu/hr)	Number at Location	Total Heat Input (MMBtu/hr)
Belvoir	1.00	60	60
Total, All Heating Units			**60.0**

Note: As there is only one class of heating units, actual emissions are based on the emission factor and heating oil use. Therefore, the rated heat input has been assigned a default value of 1, as the existing rated heat input is not known. Changing the rated heat input will not affect the actual emissions.

Heating Oil used during 2010	65,045	gal
Heat content of fuel -	139,600	BTU/gal
Sulfur content of fuel -	0.30	wt%

2.0 Emission factors, from AP-42, Section 1.3 Tables 1.3-1, 1.3-2, 1.3-7 Commercial/Institutional/ Residential Heating Units (9/98)

Constituent	Emission Factor
CO	5 lb/1000 gal fuel
NOx	20 lb/1000 gal fuel
PM-10	2.38 lb/1000 gal fuel
PM-2.5	2.13 lb/1000 gal fuel
SO_2	42.6 lb/1000 gal fuel
VOC, non-methane	0.34 lb/1000 gal fuel

(1) If the combustion source is controlled, the uncontrolled emission factors would be multiplied by the efficiency of the control device, or (1-CE).

3.0 Calculation of Criteria Pollutant Emission Rates.

Constituent	Annual Actual (lb/yr)	Annual Actual (tpy)
CO	325	0.16
NOx	1,301	0.65
PM-10	155	0.077
PM-2.5	139	0.069
SO_2	2,771	1.39
VOC	22.1	0.011

3.1 Calculation of Annual Emissions

Emission Factor (lb/1000 gal) x Fuel Usage (gal/yr) = Actual Emissions (lb/yr)

Appendix B-7b
2010 Projected Emission Calculations for Natural Gas Residential Heating Units
Fort Belvoir, Virginia

1.0 Data Required to Calculate Emissions for Natural Gas Residential Furnaces (< 0.3 and 0.3-100 MMBtu/hr)

Are there any of these sources at the facility (1 = YES, 0 = NO)? 1

Location (Building)	Rated Heat Input (BTU/hr)	Number at Location	Total Heat Input (MMBtu/hr)
Heating Units < 0.3 MMBtu/hr			
Housing Furnaces	78,000	61	4.76
Housing Water Heaters	44,240	61	2.70
Total, All Heating Units			**7.46**
Total, Heating Units < 0.3 mmBTU/hr			**7.46**

2.0 Fuel usage at facility.

Projected Natural Gas Use for 2010: 15,606,850 ft^3

Heat content of fuel - 1,000 BTU/ft^3

3.0 Calculation of Fuel Usage for Furnaces and Water Heaters < 0.3 mmBTU/hr

3.1 Annual Fuel Usage

Annual fuel usage based on heating unit size is used to calculate fuel usage by this size class (< 0.3 MMBtu/hr)

Annual fuel usage = Total heat input of this class (mmBTU/hr) ÷ Total heat input for all heating units (MMBtu/hr) x Total fuel used (cf/yr)

Annual fuel usage = 15,606,850 ft^3/yr

3.2 Hourly PTE Fuel Usage

Hourly potential to emit fuel usage is based on all furnaces and water heaters running at the same time

Total heat input, this class = 7.46 MMBtu/hr

Fuel usage = 7,457 ft^3/hr

Fuel usage = Total heat input, this class (MMBtu/hr) ÷ fuel heat content (BTU/ft^3) x 10^6 BTU/MMBtu

4.0

Emission factors, from AP-42, Section 1.4 Tables 1.4-1 and 1.4-2, Residential Furnaces

Constituent	Emission Factors for Heating Units < 0.3 mmBTU/hr
CO	40 lb/1,000,000 ft^3
NOx	94 lb/1,000,000 ft^3
PM-10	7.6 lb/1,000,000 ft^3, condensible and filterable
PM-2.5	7.6 lb/1,000,000 ft^3, condensible and filterable
SO_2	0.6 lb/1,000,000 ft^3
VOC, non-methane	5.5 lb/1,000,000 ft^3
(1) If the combustion source is controlled, the uncontrolled emission factors would be multiplied by the efficiency of the control device, or (1-CE).	

Appendix B-7b
2010 Projected Emission Calculations for Natural Gas Residential Heating Units
Fort Belvoir, Virginia

5.0 Calculation of Criteria Pollutant Emission Rates.

Constituent	Annual Actual (lb/yr)	Annual Actual (tpy)	Hourly Potential to Emit (lb/hr) (1)	Annual Potential to Emit (lb/yr) (2)	Annual Potential to Emit (tpy) (2)
CO	624	0.31	0.30	2,613	1.31
NOx	1,467	0.73	0.70	6,140	3.07
PM-10	119	0.059	0.057	496	0.25
PM-2.5	119	0.059	0.057	496	0.25
SO_2	9.364	0.005	0.004	39.2	0.020
VOC	85.8	0.043	0.041	359	0.18

(1) Hourly potential to emit fuel usage is based on all heating units running at the same time.
(2) Annual potential to emit is based on 8,760 hr/yr.

5.1 Calculation of Annual Emissions

([Emission Factor (lb/mmcf) x Fuel Usage (cf/yr)] $_{<0.3\ mmBtu/hr}$ + [Emission Factor (lb/mmcf) x Fuel Usage (cf/yr)] $_{0.3\text{-}100\ mmBtu/hr}$) / 10^6 cf/mmcf = Actual Emissions (lb/yr)

5.2 Calculation of Hourly PTE

([Emission Factor (lb/mmcf) x Fuel Usage (cf/hr)]$_{<0.3\ mmBtu/hr}$ + [Emission Factor (lb/mmcf) x Fuel Usage (cf/hr)]$_{0.3\text{-}100\ mmBtu/hr}$) / 10^6 cf/mmcf = Emissions (lb/hr)

5.3 Calculation of Annual PTE

Hourly PTE (lb/hr) x 8760 hr/yr = Potential Emissions (lb/yr)

Appendix B-8
Emission Calculations for 2011 Removed Natural Gas Residential Heating Units
Fort Belvoir, Virginia

1.0 Data Required to Calculate Emissions for Natural Gas Residential Furnaces (< 0.3 and 0.3-100 MMBtu/hr)

Are there any of these sources at the facility (1 = YES, 0 = NO)? 1

Location (Building)	Rated Heat Input (BTU/hr)	Number at Location	Total Heat Input (MMBtu/hr)
Heating Units < 0.3 MMBtu/hr			
Housing Furnaces	1	190	1.90E-04
Housing Water Heaters	1	190	1.90E-04
Total, All Heating Units			**3.80E-04**
Total, Heating Units < 0.3 mmBTU/hr			**3.80E-04**

Note: As there is only one class of heating units, actual emissions are based on the emission factor and natural gas use. Therefore, the rated heat input has been assigned a default value of 1, as the existing rated heat input is not known. Changing the rated heat input will not affect the actual emissions.

2.0 Fuel usage at facility.

Based on Natural Gas Use for 2011 7,784,053.09 ft^3

Heat content of fuel - 1,000 BTU/ft^3

3.0 Calculation of Fuel Usage for Furnaces and Water Heaters < 0.3 mmBTU/hr

3.1 Annual Fuel Usage

Annual fuel usage based on heating unit size is used to calculate fuel usage by this size class (< 0.3 MMBtu/hr)

Annual fuel usage = Total heat input of this class (mmBTU/hr) ÷ Total heat input for all heating units (MMBtu/hr) x Total fuel used (cf/yr)

Annual fuel usage = 7,784,053 ft^3/yr

4.0

Emission factors, from AP-42, Section 1.4 Tables 1.4-1 and 1.4-2, Residential Furnaces

Constituent	Emission Factors for Heating Units < 0.3 mmBTU/hr
CO	40 lb/1,000,000 ft^3
NOx	94 lb/1,000,000 ft^3
PM-10	7.6 lb/1,000,000 ft^3, condensible and filterable
PM-2.5	7.6 lb/1,000,000 ft^3, condensible and filterable
SO_2	0.6 lb/1,000,000 ft^3
VOC, non-methane	5.5 lb/1,000,000 ft^3
(1) If the combustion source is controlled, the uncontrolled emission factors would be multiplied by the efficiency of the control device, or (1-CE).	

5.0 Calculation of Criteria Pollutant Emission Rates.

Constituent	Annual Actual (lb/yr)	Annual Actual (tpy)
CO	311	0.16
NOx	732	0.37
PM-10	59.2	0.030
PM-2.5	59.2	0.030
SO_2	4.67	0.002
VOC	42.8	0.021

5.1 Calculation of Annual Emissions

Appendix B-8a
2011 Projected Emission Calculations for Natural Gas Residential Heating Units
Fort Belvoir, Virginia

1.0 Data Required to Calculate Emissions for Natural Gas Residential Furnaces (< 0.3 and 0.3-100 MMBtu/hr)

Are there any of these sources at the facility (1 = YES, 0 = NO)? 1

Location (Building)	Rated Heat Input (BTU/hr)	Number at Location	Total Heat Input (MMBtu/hr)
Heating Units < 0.3 MMBtu/hr			
Housing Furnaces	78,000	86	6.71
Housing Water Heaters	44,240	86	3.80
Total, All Heating Units			**10.5**
Total, Heating Units < 0.3 mmBTU/hr			**10.5**

2.0 Fuel usage at facility.

Projected Natural Gas Use for 2011: 22,003,100 ft^3

Heat content of fuel - 1,000 BTU/ft^3

3.0 Calculation of Fuel Usage for Furnaces and Water Heaters < 0.3 mmBTU/hr

3.1 Annual Fuel Usage

Annual fuel usage based on heating unit size is used to calculate fuel usage by this size class (< 0.3 MMBtu/hr)

Annual fuel usage = Total heat input of this class (mmBTU/hr) ÷ Total heat input for all heating units (MMBtu/hr) x Total fuel used (cf/yr)

Annual fuel usage = 22,003,100 ft^3/yr

3.2 Hourly PTE Fuel Usage

Hourly potential to emit fuel usage is based on all furnaces and water heaters running at the same time

Total heat input, this class = 10.51 MMBtu/hr

Fuel usage = 10,513 ft^3/hr

Fuel usage = Total heat input, this class (MMBtu/hr) ÷ fuel heat content (BTU/ft^3) x 10^6 BTU/MMBtu

4.0

Emission factors, from AP-42, Section 1.4 Tables 1.4-1 and 1.4-2, Residential Furnaces

Constituent	Emission Factors for Heating Units < 0.3 mmBTU/hr
CO	40 lb/1,000,000 ft^3
NOx	94 lb/1,000,000 ft^3
PM-10	7.6 lb/1,000,000 ft^3, condensible and filterable
PM-2.5	7.6 lb/1,000,000 ft^3, condensible and filterable
SO_2	0.6 lb/1,000,000 ft^3
VOC, non-methane	5.5 lb/1,000,000 ft^3
(1) If the combustion source is controlled, the uncontrolled emission factors would be multiplied by the efficiency of the control device, or (1-CE).	

Appendix B-8a
2011 Projected Emission Calculations for Natural Gas Residential Heating Units
Fort Belvoir, Virginia

5.0 Calculation of Criteria Pollutant Emission Rates.

Constituent	Annual Actual (lb/yr)	Annual Actual (tpy)	Hourly Potential to Emit (lb/hr) (1)	Annual Potential to Emit (lb/yr) (2)	Annual Potential to Emit (tpy) (2)
CO	880	0.44	0.42	3,684	1.84
NOx	2,068	1.03	0.99	8,657	4.33
PM-10	167	0.084	0.080	700	0.35
PM-2.5	167	0.084	0.080	700	0.35
SO_2	13.2	0.007	0.006	55.3	0.028
VOC	121	0.061	0.058	506	0.25
(1) Hourly potential to emit fuel usage is based on all heating units running at the same time.					
(2) Annual potential to emit is based on 8,760 hr/yr.					

5.1 Calculation of Annual Emissions

([Emission Factor (lb/mmcf) x Fuel Usage (cf/yr)] $_{<0.3\ mmBtu/hr}$ + [Emission Factor (lb/mmcf) x Fuel Usage (cf/yr)] $_{0.3\text{-}100\ mmBtu/hr}$) / 10^6 cf/mmcf = Actual Emissions (lb/yr)

5.2 Calculation of Hourly PTE

([Emission Factor (lb/mmcf) x Fuel Usage (cf/hr)]$_{<0.3\ mmBtu/hr}$ + [Emission Factor (lb/mmcf) x Fuel Usage (cf/hr)]$_{0.3\text{-}100\ mmBtu/hr}$) / 10^6 cf/mmcf = Emissions (lb/hr)

5.3 Calculation of Annual PTE

Hourly PTE (lb/hr) x 8760 hr/yr = Potential Emissions (lb/yr)

Table B-9
Emissions Calculations for Stone Crushing (2004-2011)
Fort Belvoir, Virginia

1.0 Initial data needed to calculate emissions from stone crushing operations.

Location	Emission Factor (lb/yr)	Activity Factor (ton/hr)	Operating Hours (hrs/yr)	Actual PM-10 Emissions (tons/yr)	Potential PM-10 Emissions (tons/yr)
Year 2004	5.90E-04	100.0	0	0	0
Year 2005	5.90E-04	100.0	252	0.007	0.016
Year 2006	5.90E-04	100.0	95.5	0.003	0.006
Year 2007	5.90E-04	100.0	91.0	0.003	0.006
Year 2008	5.90E-04	100.0	58.0	0.002	0.004
Year 2009	5.90E-04	100.0	20.6	0.001	0.001
Year 2010	5.90E-04	100.0	20.6	0.001	0.001
Year 2011	5.90E-04	100.0	20.6	0.001	0.001

Emission factors, from AP-42, Section 11.19, Tables 11.19.2-2, Emission Factors for Crushed Stone Operation Processes.

Calculation of Annual Actual Emissions

[Emission Factor (lb/ton) x Activity Factor (ton/hr) x Operating Hours (hr/yr)] / 2000 (lb/ton) = Actual Emissions (tpy)

Calculation of Annual Potential Emissions

Actual Emissions (tpy) x 8,760/4,056 (hr/yr) = Potential Emissions (tpy)

Note: 4,056 is the number of annual work hours planned by FBRC, LLC based on a 60 hr/wk and 18 hr/wkd work schedule

Table B-10
Emissions Calculations for Woodworking (2004-2011)
Fort Belvoir, Virginia

Revision: 4
Date: 5/25/01

1.0 Initial data needed to calculate emissions from woodworking (wall panel assembly) operations.

Location	Amount of Sawdust Captured by the Control Device (lb/yr)	Type of Control	Control Efficiency (%) [(1)]	Actual PM-10 Emissions[(2),(3)]	Potential PM-10 Emissions[(4)]
Year 2004	0	TBD	90%	0	0.000
Year 2005	25.7	TBD	90%	0.001	0.028
Year 2006	25.7	TBD	90%	0.001	0.028
Year 2007	25.7	TBD	90%	0.001	0.028
Year 2008	25.7	TBD	90%	0.001	0.028
Year 2009	25.7	TBD	90%	0.001	0.028
Year 2010	25.7	TBD	90%	0.001	0.028
Year 2011	0	TBD	90%	0	0

(1) Assume 90% efficiency for control device.
(2) Actual Particulate Emissions (lb/yr) = Quantity Disposed * [(1/Efficiency%) -1]
(3) All particulate emissions assumed to be PM-10.
(4) Uncontrolled Potential PM-10 and PM-2.5 Emissions (lb/yr) = (Quantity Disposed + Quantity Emitted with Controls) x 8760 hours/ 4,056 hours
Note: 4,056 is the number of annual work hours planned by FBRC, LLC based on a 60 hr/wk and 18 hr/wkd work schedule

Table B-11
Emissions Calculations for Concrete Batch Plant (2004-2011)
Fort Belvoir, Virginia

Revision: 4
Date: 5/25/01

1.0 Initial data needed to calculate emissions from concrete batch plant operations.

Location	Unloading						Actual PM-10 Emissions (tpy)	Po
	Process Rate (ton/yr)			Emission Factor (lb/ton of material)				
	Aggregate	Sand	Cement	Aggregate	Sand	Cement*		
Year 2004	2,295	1,757	607	0.0033	9.90E-04	9.90E-04	0.005	
Year 2005	2,295	1,757	607	0.0033	9.90E-04	9.90E-04	0.005	
Year 2006	2,295	1,757	607	0.0033	9.90E-04	9.90E-04	0.005	
Year 2007	2,295	1,757	607	0.0033	9.90E-04	9.90E-04	0.005	
Year 2008	2,295	1,757	607	0.0033	9.90E-04	9.90E-04	0.005	
Year 2009	1,350	1,034	357	0.0033	9.90E-04	9.90E-04	0.003	
Year 2010	675	517	179	0.0033	9.90E-04	9.90E-04	0.001	
Year 2011	0	0	0	0.0033	9.90E-04	9.90E-04	0	

*Cement Emission factor is based on a controlled setting
Actual Particulate Emissions (tpy) = [Process Rate (tons of material unloaded/yr) x Emission Factor (lb/ton of material unloaded) / 2000 (lb/ton)
Potential Particulate Emissions (tpy) = Actual Particulate Emissions (tpy) x 8,760 (hrs/yr)/4,056 (hrs/yr)
Emission factors obtained from AP-42, Table 11.12-2 for Concrete Batching.

Location	Weigh Hopper Loading				Control Efficiency	A
	Process Rate (ton/yr)			Emission Factor (lb/ton of material)		
	Aggregate	Sand	Cement	Weigh Hopper Loading		
Year 2004	2,295	1,757	607	0.0024	0.98	
Year 2005	2,295	1,757	607	0.0024	0.98	
Year 2006	2,295	1,757	607	0.0024	0.98	
Year 2007	2,295	1,757	607	0.0024	0.98	
Year 2008	2,295	1,757	607	0.0024	0.98	
Year 2009	1,350	1,034	357	0.0024	0.98	
Year 2010	675	517	179	0.0024	0.98	
Year 2011	0	0	0	0.0024	0.98	

*Cement Emission factor is based on a controlled setting
Actual Particulate Emissions (tpy) = [Process Rate (tons of material unloaded/yr) x Emission Factor (lb/ton of material unloaded) x (1 -Control Efficiency] / 2000 (lb/ton)
Potential Particulate Emissions (tpy) = Actual Particulate Emissions (tpy) x 8,760 (hrs/yr)/4,056 (hrs/yr)
Emission factors obtained from AP-42, Table 11.12-2 for Concrete Batching.

Table B-11
Emissions Calculations for Concrete Batch Plant (2004-2011)
Fort Belvoir, Virginia

Revision: 4
Date: 5/25/01

Location	Mixer Loading				Actual PM-10 Emissions (tpy)	Po
	Process Rate (ton/yr)			Emission Factor (lb/ton of material)		
	Aggregate	Sand	Cement	Mixer Loading		
Year 2004	2,295	1,757	607	0.011	0.026	
Year 2005	2,295	1,757	607	0.011	0.026	
Year 2006	2,295	1,757	607	0.011	0.026	
Year 2007	2,295	1,757	607	0.011	0.026	
Year 2008	2,295	1,757	607	0.011	0.026	
Year 2009	1,350	1,034	357	0.011	0.015	
Year 2010	675	517	179	0.011	0.008	
Year 2011	0	0	0	0.011	0	

*Cement Emission factor is based on a controlled setting

Actual Particulate Emissions (tpy) = [Process Rate (tons of material unloaded/yr) x Emission Factor (lb/ton of material unloaded)] / 2000 (lb/ton)

Potential Particulate Emissions (tpy) = Actual Particulate Emissions (tpy) x 8,760 (hrs/yr)/4,056 (hrs/yr)

Emission factors obtained from AP-42, Table 11.12-2 for Concrete Batching.

Location	Total Actual PM-10 Emissions (tpy)	Total Potential PM-10 Emissions (tpy)
Year 2004	0.031	0.066
Year 2005	0.031	0.066
Year 2006	0.031	0.066
Year 2007	0.031	0.066
Year 2008	0.031	0.066
Year 2009	0.018	0.039
Year 2010	0.009	0.019
Year 2011	0	0

Appendix B-12
2004 Emission Calculations for Personal Vehicles
Fort Belvoir, Virginia

1.0 Data Required to Estimate Emissions from Privately Owned Vehicles (POVs)

(b) Emission Factors can be obtained from the following:
Emission factors for NOx, CO, and VOC were obtained by running EPA's MOBILE 6 model. Emission factors for PM-10, PM-2.5, and SO2 were obtained from the EPA's PART5 model, Appendix to the PART5 User's Guide.

2.0 Calculation of On-Base Mileage for Privately Owned Vehicles (POVs)

Personnel Category	Estimated Vehicles Entering Base/Year					Miles/Vehicle/ Day [3]	Total POVs per Year	Total Miles per Year
	Daily	Weekend	Annual [1]	% of Employees that drive to base	Adjusted Vehicles per year [2]			
Daily Employees	132		34,320	100%	34,320	4.00	132	137,280
Weekend Employees		132	13,728	100%	13,728	4.00	132	54,912
TOTAL (POVs)								**192,192**

(1) Estimate the annual number of vehicles entering the base per year:
e.g. Employee Vehicles/Day x 5 (day/wk) x 52 (wks/yr) + Employee Vehicles/weekend day x 2 day/month = Annual Vehicles Entering Base per Year for All Employees
(2) Estimate the adjusted vehicles per year for both the daily and weekend employees:
(3) This is the average on-base distance traveled by employees in their personal vehicles.

Appendix B-12
2004 Emission Calculations for Personal Vehicles
Fort Belvoir, Virginia

3.0 Calculation of Criteria Pollutant Emission Rates

Vehicle Category [1]	Average Vehicle Model Year [2]	Number of Vehicles	Annual On-Base Mileage	Fleet Vehicle Emission Factors (gm/mile)						Actual Emissions (lb/yr)					
				CO	VOC	NO_X	SO_X	PM-10	PM-2.5	CO	VOC	NO_X	SO_X	PM-10	PM-2.5
Privately Owned Vehicles (POVs) - Daily Employees				**1997 Average Model Year Emission Factors (Low Altitude)**											
LDGV (68.9% of Total POVs)	1997	91	94,586	14.4	0.90	0.90	0.10	0.71	0.20	2,996	189	187	20.8	148	41.6
LDGT12 (11.4% of Total POVs)	1997	15	15,650	16.1	1.00	1.40	0.10	1.08	0.29	554	34.7	48.2	3.44	37.2	9.98
LDGT34 (8.5% of Total POVs)	1997	11	11,669	17.6	1.10	1.80	0.10	2.58	0.66	452	28.5	46.2	2.57	66.2	16.9
HDGV (1.5% of Total POVs)	1997	2	2,059	10.2	0.70	4.50	0.20	5.51	1.42	46.2	3.20	20.4	0.91	25.0	6.43
LDDV (3.9% of Total POVs)	1997	5	5,354	1.20	0.30	1.10	0.10	0.80	0.28	14.1	3.57	13.0	1.18	9.42	3.30
LDDT (1.9% of Total POVs)	1997	3	2,608	14.5	0.50	1.30	0.20	1.59	0.48	83.2	2.89	7.46	1.15	9.12	2.75
HDDV (2.9% of Total POVs)	1997	4	3,981	2.50	0.50	16.0	0.50	7.73	2.01	21.9	4.42	140	4.38	67.7	17.6
MC (1% of Total POVs)	1997	1	1,373	16.9	2.80	1.20	0.030	0.080	0.030	51.0	8.53	3.62	0.09	0.24	0.091
Privately Owned Vehicles (POVs) - Weekend Employees															
LDGV (68.9% of Total POVs)	1997	91	37,834	14.4	0.90	0.90	0.10	0.71	0.20	1,199	75.6	74.9	8.32	59.1	16.65
LDGT12 (11.4% of Total POVs)	1997	15	6,260	16.1	1.00	1.40	0.10	1.08	0.29	222	13.90	19.28	1.38	14.87	3.99
LDGT34 (8.5% of Total POVs)	1997	11	4,668	17.6	1.10	1.80	0.10	2.58	0.66	181	11.40	18.49	1.03	26.5	6.78
HDGV (1.5% of Total POVs)	1997	2	824	10.2	0.70	4.50	0.20	5.51	1.42	18.5	1.28	8.16	0.36	9.99	2.57
LDDV (3.9% of Total POVs)	1997	5	2,142	1.2	0.30	1.10	0.10	0.80	0.28	5.65	1.43	5.18	0.47	3.77	1.32
LDDT (1.9% of Total POVs)	1997	3	1,043	14.5	0.50	1.30	0.20	1.59	0.48	33.3	1.16	2.98	0.46	3.65	1.10
HDDV (2.9% of Total POVs)	1997	4	1,592	2.5	0.50	16.0	0.50	7.73	2.01	8.76	1.77	56.0	1.75	27.1	7.04
MC (1% of Total POVs)	1997	1	549	16.9	2.80	1.20	0.030	0.080	0.030	20.4	3.41	1.45	0.036	0.097	0.036
TOTAL EMISSIONS (lb/yr)										**5,907**	**385**	**653**	**48.3**	**508**	**138**
TOTAL EMISSIONS (tpy)										**2.95**	**0.19**	**0.33**	**0.024**	**0.25**	**0.069**

(1) POVs were classified into vehicle categories based on an average on-road vehicle mix provided in AP-42, Volume II
The same average on-road mix was applied to the estimated number of Daily Employee and Weekend Employee POVs.
For example, Daily Employee POVs in LDGV category = 68.9% (LDGV/Total POVs) x Total Daily Employee POVs
Weekend Employee POVs in LDGV category = 68.9% (LDGV/Total POVs) x Total UTA Employee POVs

(2) Annual on-base mileage is for all the vehicles in a vehicle category. In the case of POVs, the annual on-base mileage is apportioned to daily employee and weekend employee vehicle categories based on the ratio of the number of vehicles in a particular category to the toal number of POVs in that employee category.
For example, Annual On-base Mileage for Daily Employee POVs in LDGV category = Total Daily Employee Miles per Year x (Daily Employee LDGVs / Total Daily Employee POVs)
Annual On-base Mileage for Weekend Employee POVs in LDGV category = Total Weekend Employee Miles per Year x (Weekend Employee LDGVs / Total Weekend Employee POVs)

2.1 Calculation of Annual Actual Emissions

Emission Factor (gm/mile) x Annual On-Base Mileage x 0.0022 (lb/gm) = Actual Emissions (lb/yr)

Appendix B-13
2005 Emission Calculations for Personal Vehicles
Fort Belvoir, Virginia

1.0 Data Required to Estimate Emissions from Privately Owned Vehicles (POVs)

(b) Emission Factors can be obtained from the following:
Emission factors for NOx, CO, and VOC were obtained by running EPA's MOBILE 6 model. Emission factors for PM-10, PM-2.5, and SO2 were obtained from the EPA's PART5 model, Appendix to the PART5 User's Guide.

2.0 Calculation of On-Base Mileage for Privately Owned Vehicles (POVs)

Personnel Category	Estimated Vehicles Entering Base/Year					Miles/Vehicle/ Day [3]	Total POVs per Year	Total Miles per Year
	Daily	Weekend	Annual [1]	% of Employees that drive to base	Adjusted Vehicles per year [2]			
Daily Employees	132		34,320	100%	34,320	4.00	132	137,280
Weekend Employees		132	13,728	100%	13,728	4.00	132	54,912
TOTAL (POVs)								**192,192**

(1) Estimate the annual number of vehicles entering the base per year:
e.g. Employee Vehicles/Day x 5 (day/wk) x 52 (wks/yr) + Employee Vehicles/weekend day x 2 day/month = Annual Vehicles Entering Base per Year for All Employees
(2) Estimate the adjusted vehicles per year for both the daily and weekend employees:
(3) This is the average on-base distance traveled by employees in their personal vehicles.

Appendix B-13
2005 Emission Calculations for Personal Vehicles
Fort Belvoir, Virginia

3.0 Calculation of Criteria Pollutant Emission Rates

Vehicle Category [1]	Average Vehicle Model Year [2]	Number of Vehicles	Annual On-Base Mileage	Fleet Vehicle Emission Factors (gm/mile)						Actual Emissions (lb/yr)					
				CO	VOC	NO_X	SO_X	PM-10	PM-2.5	CO	VOC	NO_X	SO_X	PM-10	PM-2.5
Privately Owned Vehicles (POVs) - Daily Employees				**1997 Average Model Year Emission Factors (Low Altitude)**											
LDGV (68.9% of Total POVs)	1997	91	94,586	14.4	0.90	0.90	0.10	0.71	0.20	2,996	189	187	20.8	148	41.6
LDGT12 (11.4% of Total POVs)	1997	15	15,650	16.1	1.00	1.40	0.10	1.08	0.29	554	34.7	48.2	3.44	37.2	9.98
LDGT34 (8.5% of Total POVs)	1997	11	11,669	17.6	1.10	1.80	0.10	2.58	0.66	452	28.5	46.2	2.57	66.2	16.9
HDGV (1.5% of Total POVs)	1997	2	2,059	10.2	0.70	4.50	0.20	5.51	1.42	46.2	3.20	20.4	0.91	25.0	6.43
LDDV (3.9% of Total POVs)	1997	5	5,354	1.20	0.30	1.10	0.10	0.80	0.28	14.1	3.57	12.96	1.18	9.42	3.30
LDDT (1.9% of Total POVs)	1997	3	2,608	14.5	0.50	1.30	0.20	1.59	0.48	83.2	2.89	7.46	1.15	9.12	2.75
HDDV (2.9% of Total POVs)	1997	4	3,981	2.50	0.50	16.0	0.50	7.73	2.01	21.9	4.42	140.1	4.38	67.7	17.6
MC (1% of Total POVs)	1997	1	1,373	16.9	2.80	1.20	0.030	0.080	0.030	51.0	8.53	3.62	0.09	0.24	0.091
Privately Owned Vehicles (POVs) - Weekend Employees															
LDGV (68.9% of Total POVs)	1997	91	37,834	14.4	0.90	0.90	0.10	0.71	0.20	1,199	75.6	74.9	8.32	59.1	16.6
LDGT12 (11.4% of Total POVs)	1997	15	6,260	16.1	1.00	1.40	0.10	1.08	0.29	222	13.9	19.28	1.38	14.9	3.99
LDGT34 (8.5% of Total POVs)	1997	11	4,668	17.6	1.10	1.80	0.10	2.58	0.66	181	11.4	18.49	1.03	26.5	6.78
HDGV (1.5% of Total POVs)	1997	2	824	10.2	0.70	4.50	0.20	5.51	1.42	18.5	1.28	8.16	0.36	9.99	2.57
LDDV (3.9% of Total POVs)	1997	5	2,142	1.2	0.30	1.10	0.10	0.80	0.28	5.65	1.43	5.18	0.47	3.77	1.32
LDDT (1.9% of Total POVs)	1997	3	1,043	14.5	0.50	1.30	0.20	1.59	0.48	33.3	1.16	2.98	0.46	3.65	1.10
HDDV (2.9% of Total POVs)	1997	4	1,592	2.5	0.50	16.0	0.50	7.73	2.01	8.76	1.77	56.0	1.75	27.1	7.04
MC (1% of Total POVs)	1997	1	549	16.9	2.80	1.20	0.030	0.080	0.030	20.4	3.41	1.45	0.036	0.097	0.036
TOTAL EMISSIONS (lb/yr)										**5,907**	**385**	**653**	**48.3**	**508**	**138**
TOTAL EMISSIONS (tpy)										**2.95**	**0.19**	**0.33**	**0.024**	**0.25**	**0.069**

(1) POVs were classified into vehicle categories based on an average on-road vehicle mix provided in AP-42, Volume II
The same average on-road mix was applied to the estimated number of Daily Employee and Weekend Employee POVs.
For example, Daily Employee POVs in LDGV category = 68.9% (LDGV/Total POVs) x Total Daily Employee POVs
Weekend Employee POVs in LDGV category = 68.9% (LDGV/Total POVs) x Total UTA Employee POVs
(2) Annual on-base mileage is for all the vehicles in a vehicle category. In the case of POVs, the annual on-base mileage is apportioned to daily employee and weekend employee vehicle categories based on the ratio of the number of vehicles in a particular category to the toal number of POVs in that employee category.
For example, Annual On-base Mileage for Daily Employee POVs in LDGV category = Total Daily Employee Miles per Year x (Daily Employee LDGVs / Total Daily Employee POVs)
Annual On-base Mileage for Weekend Employee POVs in LDGV category = Total Weekend Employee Miles per Year x (Weekend Employee LDGVs / Total Weekend Employee POVs)

2.1 Calculation of Annual Actual Emissions

Emission Factor (gm/mile) x Annual On-Base Mileage x 0.0022 (lb/gm) = Actual Emissions (lb/yr)

Appendix B-14
2006 Emission Calculations for Personal Vehicles
Fort Belvoir, Virginia

1.0 Data Required to Estimate Emissions from Privately Owned Vehicles (POVs)

(b) Emission Factors can be obtained from the following:
Emission factors for NOx, CO, and VOC were obtained by running EPA's MOBILE 6 model. Emission factors for PM-10, PM-2.5, and SO2 were obtained from the EPA's PART5 model, Appendix to the PART5 User's Guide.

2.0 Calculation of On-Base Mileage for Privately Owned Vehicles (POVs)

Personnel Category	Estimated Vehicles Entering Base/Year					Miles/Vehicle/ Day [3]	Total POVs per Year	Total Miles per Year
	Daily	Weekend	Annual [1]	% of Employees that drive to base	Adjusted Vehicles per year [2]			
Daily Employees	240		62,400	100%	62,400	4.00	240	249,600
Weekend Employees		240	24,960	100%	24,960	4.00	240	99,840
TOTAL (POVs)								**349,440**

(1) Estimate the annual number of vehicles entering the base per year:
e.g. Employee Vehicles/Day x 5 (day/wk) x 52 (wks/yr) + Employee Vehicles/weekend day x 2 day/month = Annual Vehicles Entering Base per Year for All Employees
(2) Estimate the adjusted vehicles per year for both the daily and weekend employees:
(3) This is the average on-base distance traveled by employees in their personal vehicles.

Appendix B-14
2006 Emission Calculations for Personal Vehicles
Fort Belvoir, Virginia

3.0 Calculation of Criteria Pollutant Emission Rates

Vehicle Category [1]	Average Vehicle Model Year [2]	Number of Vehicles	Annual On-Base Mileage	Fleet Vehicle Emission Factors (gm/mile)						Actual Emissions (lb/yr)					
				CO	VOC	NO_X	SO_X	PM-10	PM-2.5	CO	VOC	NO_X	SO_X	PM-10	PM-2.5
Privately Owned Vehicles (POVs) - Daily Employees				**1997 Average Model Year Emission Factors (Low Altitude)**											
LDGV (68.9% of Total POVs)	1997	165	171,974	14.4	0.90	0.90	0.10	0.71	0.20	5,448	344	341	37.8	269	75.7
LDGT12 (11.4% of Total POVs)	1997	27	28,454	16.1	1.00	1.40	0.10	1.08	0.29	1,008	63.2	87.6	6.26	67.6	18.2
LDGT34 (8.5% of Total POVs)	1997	20	21,216	17.6	1.10	1.80	0.10	2.58	0.66	821	51.8	84.0	4.67	120.4	30.8
HDGV (1.5% of Total POVs)	1997	4	3,744	10.2	0.70	4.50	0.20	5.51	1.42	84.0	5.82	37.1	1.65	45.4	11.7
LDDV (3.9% of Total POVs)	1997	9	9,734	1.20	0.30	1.10	0.10	0.80	0.28	25.7	6.48	23.6	2.14	17.13	6.00
LDDT (1.9% of Total POVs)	1997	5	4,742	14.5	0.50	1.30	0.20	1.59	0.48	151	5.26	13.56	2.09	16.6	5.01
HDDV (2.9% of Total POVs)	1997	7	7,238	2.50	0.50	16.0	0.50	7.73	2.01	39.8	8.03	255	7.96	123	32.0
MC (1% of Total POVs)	1997	2	2,496	16.9	2.80	1.20	0.030	0.080	0.030	92.8	15.52	6.59	0.16	0.44	0.16
Privately Owned Vehicles (POVs) - WeekendEmployees															
LDGV (68.9% of Total POVs)	1997	165	68,790	14.4	0.90	0.90	0.10	0.71	0.20	2,179	137	136	15.1	107	30.3
LDGT12 (11.4% of Total POVs)	1997	27	11,382	16.1	1.00	1.40	0.10	1.08	0.29	403	25.3	35.1	2.50	27.0	7.26
LDGT34 (8.5% of Total POVs)	1997	20	8,486	17.6	1.10	1.80	0.10	2.58	0.66	329	20.7	33.6	1.87	48.2	12.3
HDGV (1.5% of Total POVs)	1997	4	1,498	10.2	0.70	4.50	0.20	5.51	1.42	33.6	2.33	14.83	0.66	18.2	4.68
LDDV (3.9% of Total POVs)	1997	9	3,894	1.2	0.30	1.10	0.10	0.80	0.28	10.3	2.59	9.42	0.86	6.85	2.40
LDDT (1.9% of Total POVs)	1997	5	1,897	14.5	0.50	1.30	0.20	1.59	0.48	60.5	2.11	5.43	0.83	6.64	2.00
HDDV (2.9% of Total POVs)	1997	7	2,895	2.5	0.50	16.0	0.50	7.73	2.01	15.9	3.21	102	3.18	49.2	12.8
MC (1% of Total POVs)	1997	2	998	16.9	2.80	1.20	0.030	0.080	0.030	37.1	6.20	2.63	0.066	0.18	0.066
TOTAL EMISSIONS (lb/yr)										**10,739**	**700**	**1,187**	**87.9**	**923**	**251**
TOTAL EMISSIONS (tpy)										**5.37**	**0.35**	**0.59**	**0.044**	**0.46**	**0.13**

(1) POVs were classified into vehicle categories based on an average on-road vehicle mix provided in AP-42, Volume II
The same average on-road mix was applied to the estimated number of Daily Employee and Weekend Employee POVs.
For example, Daily Employee POVs in LDGV category = 68.9% (LDGV/Total POVs) x Total Daily Employee POVs
Weekend Employee POVs in LDGV category = 68.9% (LDGV/Total POVs) x Total UTA Employee POVs

(2) Annual on-base mileage is for all the vehicles in a vehicle category. In the case of POVs, the annual on-base mileage is apportioned to daily employee and weekend employee vehicle categories based on the ratio of the number of vehicles in a particular category to the toal number of POVs in that employee category.
For example, Annual On-base Mileage for Daily Employee POVs in LDGV category = Total Daily Employee Miles per Year x (Daily Employee LDGVs / Total Daily Employee POVs)
Annual On-base Mileage for Weekend Employee POVs in LDGV category = Total Weekend Employee Miles per Year x (Weekend Employee LDGVs / Total Weekend Employee POVs)

2.1 Calculation of Annual Actual Emissions

Emission Factor (gm/mile) x Annual On-Base Mileage x 0.0022 (lb/gm) = Actual Emissions (lb/yr)

Appendix B-15
2007 Emission Calculations for Personal Vehicles
Fort Belvoir, Virginia

1.0 Data Required to Estimate Emissions from Privately Owned Vehicles (POVs)

(b) Emission Factors can be obtained from the following:
Emission factors for NOx, CO, and VOC were obtained by running EPA's MOBILE 6 model. Emission factors for PM-10, PM-2.5, and SO2 were obtained from the EPA's PART5 model, Appendix to the PART5 User's Guide.

2.0 Calculation of On-Base Mileage for Privately Owned Vehicles (POVs)

Personnel Category	Estimated Vehicles Entering Base/Year					Miles/Vehicle/ Day [3]	Total POVs per Year	Total Miles per Year
	Daily	Weekend	Annual [1]	% of Employees that drive to base	Adjusted Vehicles per year [2]			
Daily Employees	240		62,400	100%	62,400	4.00	240	249,600
Weekend Employees		240	24,960	100%	24,960	4.00	240	99,840
TOTAL (POVs)								**349,440**

(1) Estimate the annual number of vehicles entering the base per year:
e.g. Employee Vehicles/Day x 5 (day/wk) x 52 (wks/yr) + Employee Vehicles/weekend day x 2 day/month = Annual Vehicles Entering Base per Year for All Employees
(2) Estimate the adjusted vehicles per year for both the daily and weekend employees:
(3) This is the average on-base distance traveled by employees in their personal vehicles.

Appendix B-15
2007 Emission Calculations for Personal Vehicles
Fort Belvoir, Virginia

3.0 Calculation of Criteria Pollutant Emission Rates

Vehicle Category [1]	Average Vehicle Model Year [2]	Number of Vehicles	Annual On-Base Mileage	Fleet Vehicle Emission Factors (gm/mile)						Actual Emissions (lb/yr)					
				CO	VOC	NO_X	SO_X	PM-10	PM-2.5	CO	VOC	NO_X	SO_X	PM-10	PM-2.5
Privately Owned Vehicles (POVs) - Daily Employees				**1997 Average Model Year Emission Factors (Low Altitude)**											
LDGV (68.9% of Total POVs)	1997	165	171,974	14.4	0.90	0.90	0.10	0.71	0.20	5,448	344	341	37.8	269	75.7
LDGT12 (11.4% of Total POVs)	1997	27	28,454	16.1	1.00	1.40	0.10	1.08	0.29	1,008	63.2	87.6	6.26	67.6	18.2
LDGT34 (8.5% of Total POVs)	1997	20	21,216	17.6	1.10	1.80	0.10	2.58	0.66	821	51.8	84.0	4.67	120	30.8
HDGV (1.5% of Total POVs)	1997	4	3,744	10.2	0.70	4.50	0.20	5.51	1.42	84	5.82	37.1	1.65	45.4	11.7
LDDV (3.9% of Total POVs)	1997	9	9,734	1.20	0.30	1.10	0.10	0.80	0.28	25.7	6.48	23.6	2.14	17.1	6.00
LDDT (1.9% of Total POVs)	1997	5	4,742	14.5	0.50	1.30	0.20	1.59	0.48	151	5.26	13.6	2.09	16.6	5.01
HDDV (2.9% of Total POVs)	1997	7	7,238	2.50	0.50	16.0	0.50	7.73	2.01	39.8	8.03	255	7.96	123	32.0
MC (1% of Total POVs)	1997	2	2,496	16.9	2.80	1.20	0.030	0.080	0.030	92.8	15.5	6.59	0.16	0.44	0.16
Privately Owned Vehicles (POVs) - Weekend Employees															
LDGV (68.9% of Total POVs)	1997	165	68,790	14.4	0.90	0.90	0.10	0.71	0.20	2,179	137	136	15.1	107	30.3
LDGT12 (11.4% of Total POVs)	1997	27	11,382	16.1	1.00	1.40	0.10	1.08	0.29	403	25.3	35.1	2.50	27.0	7.26
LDGT34 (8.5% of Total POVs)	1997	20	8,486	17.6	1.10	1.80	0.10	2.58	0.66	329	20.7	33.6	1.87	48.2	12.3
HDGV (1.5% of Total POVs)	1997	4	1,498	10.2	0.70	4.50	0.20	5.51	1.42	33.6	2.33	14.8	0.66	18.2	4.68
LDDV (3.9% of Total POVs)	1997	9	3,894	1.2	0.30	1.10	0.10	0.80	0.28	10.3	2.59	9.42	0.86	6.85	2.40
LDDT (1.9% of Total POVs)	1997	5	1,897	14.5	0.50	1.30	0.20	1.59	0.48	60.5	2.11	5.43	0.83	6.64	2.00
HDDV (2.9% of Total POVs)	1997	7	2,895	2.5	0.50	16.0	0.50	7.73	2.01	15.9	3.21	102	3.18	49.2	12.8
MC (1% of Total POVs)	1997	2	998	16.9	2.80	1.20	0.030	0.080	0.030	37.1	6.20	2.63	0.066	0.18	0.066
TOTAL EMISSIONS (lb/yr)										**10,739**	**700**	**1,187**	**87.9**	**923**	**251**
TOTAL EMISSIONS (tpy)										**5.37**	**0.35**	**0.59**	**0.044**	**0.46**	**0.13**

(1) POVs were classified into vehicle categories based on an average on-road vehicle mix provided in AP-42, Volume II
The same average on-road mix was applied to the estimated number of Daily Employee and Weekend Employee POVs.
For example, Daily Employee POVs in LDGV category = 68.9% (LDGV/Total POVs) x Total Daily Employee POVs
Weekend Employee POVs in LDGV category = 68.9% (LDGV/Total POVs) x Total UTA Employee POVs

(2) Annual on-base mileage is for all the vehicles in a vehicle category. In the case of POVs, the annual on-base mileage is apportioned to daily employee and weekend employee vehicle categories based on the ratio of the number of vehicles in a particular category to the toal number of POVs in that employee category.
For example, Annual On-base Mileage for Daily Employee POVs in LDGV category = Total Daily Employee Miles per Year x (Daily Employee LDGVs / Total Daily Employee POVs)
Annual On-base Mileage for Weekend Employee POVs in LDGV category = Total Weekend Employee Miles per Year x (Weekend Employee LDGVs / Total Weekend Employee POVs)

2.1 Calculation of Annual Actual Emissions

Emission Factor (gm/mile) x Annual On-Base Mileage x 0.0022 (lb/gm) = Actual Emissions (lb/yr)

Appendix B-16
2008 Emission Calculations for Personal Vehicles
Fort Belvoir, Virginia

1.0 Data Required to Estimate Emissions from Privately Owned Vehicles (POVs)

(b) Emission Factors can be obtained from the following:
Emission factors for NOx, CO, and VOC were obtained by running EPA's MOBILE 6 model. Emission factors for PM-10, PM-2.5, and SO2 were obtained from the EPA's PART5 model, Appendix to the PART5 User's Guide.

2.0 Calculation of On-Base Mileage for Privately Owned Vehicles (POVs)

Personnel Category	Estimated Vehicles Entering Base/Year					Miles/Vehicle/ Day [3]	Total POVs per Year	Total Miles per Year
	Daily	Weekend	Annual [1]	% of Employees that drive to base	Adjusted Vehicles per year [2]			
Daily Employees	240		62,400	100%	62,400	4.00	240	249,600
Weekend Employees		240	24,960	100%	24,960	4.00	240	99,840
TOTAL (POVs)								**349,440**

(1) Estimate the annual number of vehicles entering the base per year:
e.g. Employee Vehicles/Day x 5 (day/wk) x 52 (wks/yr) + Employee Vehicles/weekend day x 2 day/month = Annual Vehicles Entering Base per Year for All Employees
(2) Estimate the adjusted vehicles per year for both the daily and weekend employees:
(3) This is the average on-base distance traveled by employees in their personal vehicles.

Appendix B-16
2008 Emission Calculations for Personal Vehicles
Fort Belvoir, Virginia

3.0 Calculation of Criteria Pollutant Emission Rates

Vehicle Category [1]	Average Vehicle Model Year [2]	Number of Vehicles	Annual On-Base Mileage	Fleet Vehicle Emission Factors (gm/mile)						Actual Emissions (lb/yr)					
				CO	VOC	NO_X	SO_X	PM-10	PM-2.5	CO	VOC	NO_X	SO_X	PM-10	PM-2.5
Privately Owned Vehicles (POVs) - Daily Employees				**1997 Average Model Year Emission Factors (Low Altitude)**											
LDGV (68.9% of Total POVs)	1997	165	171,974	14.4	0.90	0.90	0.10	0.71	0.20	5,448	344	341	37.8	269	75.7
LDGT12 (11.4% of Total POVs)	1997	27	28,454	16.1	1.00	1.40	0.10	1.08	0.29	1,008	63.2	87.6	6.26	67.6	18.2
LDGT34 (8.5% of Total POVs)	1997	20	21,216	17.6	1.10	1.80	0.10	2.58	0.66	821	51.8	84.0	4.67	120	30.8
HDGV (1.5% of Total POVs)	1997	4	3,744	10.2	0.70	4.50	0.20	5.51	1.42	84.0	5.82	37.1	1.65	45.4	11.7
LDDV (3.9% of Total POVs)	1997	9	9,734	1.20	0.30	1.10	0.10	0.80	0.28	25.7	6.48	23.6	2.14	17.1	6.00
LDDT (1.9% of Total POVs)	1997	5	4,742	14.5	0.50	1.30	0.20	1.59	0.48	151	5.26	13.6	2.09	16.6	5.01
HDDV (2.9% of Total POVs)	1997	7	7,238	2.50	0.50	16.0	0.50	7.73	2.01	39.8	8.03	255	7.96	123	32.0
MC (1% of Total POVs)	1997	2	2,496	16.9	2.80	1.20	0.030	0.080	0.030	92.8	15.52	6.59	0.16	0.44	0.16
Privately Owned Vehicles (POVs) - Weekend Employees															
LDGV (68.9% of Total POVs)	1997	165	68,790	14.4	0.90	0.90	0.10	0.71	0.20	2,179	137	136	15.1	107	30.3
LDGT12 (11.4% of Total POVs)	1997	27	11,382	16.1	1.00	1.40	0.10	1.08	0.29	403	25.3	35.1	2.50	27.0	7.26
LDGT34 (8.5% of Total POVs)	1997	20	8,486	17.6	1.10	1.80	0.10	2.58	0.66	329	20.7	33.6	1.87	48.2	12.3
HDGV (1.5% of Total POVs)	1997	4	1,498	10.2	0.70	4.50	0.20	5.51	1.42	33.6	2.33	14.8	0.66	18.16	4.68
LDDV (3.9% of Total POVs)	1997	9	3,894	1.2	0.30	1.10	0.10	0.80	0.28	10.3	2.59	9.42	0.86	6.85	2.40
LDDT (1.9% of Total POVs)	1997	5	1,897	14.5	0.50	1.30	0.20	1.59	0.48	60.5	2.11	5.43	0.83	6.64	2.00
HDDV (2.9% of Total POVs)	1997	7	2,895	2.5	0.50	16.0	0.50	7.73	2.01	15.9	3.21	102	3.18	49.2	12.8
MC (1% of Total POVs)	1997	2	998	16.9	2.80	1.20	0.030	0.080	0.030	37.1	6.20	2.63	0.066	0.18	0.066
TOTAL EMISSIONS (lb/yr)										**10,739**	**700**	**1,187**	**87.9**	**923**	**251**
TOTAL EMISSIONS (tpy)										**5.37**	**0.35**	**0.59**	**0.044**	**0.46**	**0.13**

(1) POVs were classified into vehicle categories based on an average on-road vehicle mix provided in AP-42, Volume II
The same average on-road mix was applied to the estimated number of Daily Employee and Weekend Employee POVs.
For example, Daily Employee POVs in LDGV category = 68.9% (LDGV/Total POVs) x Total Daily Employee POVs
Weekend Employee POVs in LDGV category = 68.9% (LDGV/Total POVs) x Total UTA Employee POVs

(2) Annual on-base mileage is for all the vehicles in a vehicle category. In the case of POVs, the annual on-base mileage is apportioned to daily employee and weekend employee vehicle categories based on the ratio of the number of vehicles in a particular category to the toal number of POVs in that employee category.
For example, Annual On-base Mileage for Daily Employee POVs in LDGV category = Total Daily Employee Miles per Year x (Daily Employee LDGVs / Total Daily Employee POVs)
Annual On-base Mileage for Weekend Employee POVs in LDGV category = Total Weekend Employee Miles per Year x (Weekend Employee LDGVs / Total Weekend Employee POVs)

2.1 Calculation of Annual Actual Emissions

Emission Factor (gm/mile) x Annual On-Base Mileage x 0.0022 (lb/gm) = Actual Emissions (lb/yr)

Appendix B-17
2009 Emission Calculations for Personal Vehicles
Fort Belvoir, Virginia

1.0 Data Required to Estimate Emissions from Privately Owned Vehicles (POVs)

(b) Emission Factors can be obtained from the following:
Emission factors for NOx, CO, and VOC were obtained by running EPA's MOBILE 6 model. Emission factors for PM-10, PM-2.5, and SO2 were obtained from the EPA's PART5 model, Appendix to the PART5 User's Guide.

2.0 Calculation of On-Base Mileage for Privately Owned Vehicles (POVs)

Personnel Category	Estimated Vehicles Entering Base/Year					Miles/Vehicle/ Day [3]	Total POVs per Year	Total Miles per Year
	Daily	Weekend	Annual [1]	% of Employees that drive to base	Adjusted Vehicles per year [2]			
Daily Employees	132		34,320	100%	34,320	4.00	132	137,280
Weekend Employees		132	13,728	100%	13,728	4.00	132	54,912
TOTAL (POVs)								**192,192**

(1) Estimate the annual number of vehicles entering the base per year:
e.g. Employee Vehicles/Day x 5 (day/wk) x 52 (wks/yr) + Employee Vehicles/weekend day x 2 day/month = Annual Vehicles Entering Base per Year for All Employees
(2) Estimate the adjusted vehicles per year for both the daily and weekend employees:
(3) This is the average on-base distance traveled by employees in their personal vehicles.

Appendix B-17
2009 Emission Calculations for Personal Vehicles
Fort Belvoir, Virginia

3.0 Calculation of Criteria Pollutant Emission Rates

Vehicle Category [1]	Average Vehicle Model Year [2]	Number of Vehicles	Annual On-Base Mileage	Fleet Vehicle Emission Factors (gm/mile)						Actual Emissions (lb/yr)					
				CO	VOC	NO_X	SO_X	PM-10	PM-2.5	CO	VOC	NO_X	SO_X	PM-10	PM-2.5
Privately Owned Vehicles (POVs) - Daily Employees				**1997 Average Model Year Emission Factors (Low Altitude)**											
LDGV (68.9% of Total POVs)	1997	91	94,586	14.4	0.90	0.90	0.10	0.71	0.20	2,996	189	187	20.8	148	41.6
LDGT12 (11.4% of Total POVs)	1997	15	15,650	16.1	1.00	1.40	0.10	1.08	0.29	554	34.7	48.2	3.44	37.2	9.98
LDGT34 (8.5% of Total POVs)	1997	11	11,669	17.6	1.10	1.80	0.10	2.58	0.66	452	28.5	46.2	2.57	66.2	16.9
HDGV (1.5% of Total POVs)	1997	2	2,059	10.2	0.70	4.50	0.20	5.51	1.42	46.2	3.20	20.4	0.91	25.0	6.43
LDDV (3.9% of Total POVs)	1997	5	5,354	1.20	0.30	1.10	0.10	0.80	0.28	14.1	3.57	13.0	1.18	9.42	3.30
LDDT (1.9% of Total POVs)	1997	3	2,608	14.5	0.50	1.30	0.20	1.59	0.48	83.2	2.89	7.46	1.15	9.12	2.75
HDDV (2.9% of Total POVs)	1997	4	3,981	2.50	0.50	16.0	0.50	7.73	2.01	21.9	4.42	140	4.38	67.7	17.6
MC (1% of Total POVs)	1997	1	1,373	16.9	2.80	1.20	0.030	0.080	0.030	51.0	8.53	3.62	0.091	0.24	0.091
Privately Owned Vehicles (POVs) - Weekend Employees															
LDGV (68.9% of Total POVs)	1997	91	37,834	14.4	0.90	0.90	0.10	0.71	0.20	1,199	75.6	74.9	8.32	59.1	16.6
LDGT12 (11.4% of Total POVs)	1997	15	6,260	16.1	1.00	1.40	0.10	1.08	0.29	222	13.9	19.3	1.38	14.9	3.99
LDGT34 (8.5% of Total POVs)	1997	11	4,668	17.6	1.10	1.80	0.10	2.58	0.66	181	11.4	18.5	1.03	26.5	6.78
HDGV (1.5% of Total POVs)	1997	2	824	10.2	0.70	4.50	0.20	5.51	1.42	18.5	1.28	8.16	0.36	9.99	2.57
LDDV (3.9% of Total POVs)	1997	5	2,142	1.2	0.30	1.10	0.10	0.80	0.28	5.65	1.43	5.18	0.47	3.77	1.32
LDDT (1.9% of Total POVs)	1997	3	1,043	14.5	0.50	1.30	0.20	1.59	0.48	33.3	1.16	2.98	0.46	3.65	1.10
HDDV (2.9% of Total POVs)	1997	4	1,592	2.5	0.50	16.0	0.50	7.73	2.01	8.76	1.77	56.0	1.75	27.1	7.04
MC (1% of Total POVs)	1997	1	549	16.9	2.80	1.20	0.030	0.080	0.030	20.4	3.41	1.45	0.036	0.10	0.036
TOTAL EMISSIONS (lb/yr)										**5,907**	**385**	**653**	**48.3**	**508**	**138**
TOTAL EMISSIONS (tpy)										**2.95**	**0.19**	**0.33**	**0.024**	**0.25**	**0.069**

(1) POVs were classified into vehicle categories based on an average on-road vehicle mix provided in AP-42, Volume II
The same average on-road mix was applied to the estimated number of Daily Employee and Weekend Employee POVs.
For example, Daily Employee POVs in LDGV category = 68.9% (LDGV/Total POVs) x Total Daily Employee POVs
Weekend Employee POVs in LDGV category = 68.9% (LDGV/Total POVs) x Total UTA Employee POVs
(2) Annual on-base mileage is for all the vehicles in a vehicle category. In the case of POVs, the annual on-base mileage is apportioned to daily employee and weekend employee vehicle categories based on the ratio of the number of vehicles in a particular category to the toal number of POVs in that employee category.
For example, Annual On-base Mileage for Daily Employee POVs in LDGV category = Total Daily Employee Miles per Year x (Daily Employee LDGVs / Total Daily Employee POVs)
Annual On-base Mileage for Weekend Employee POVs in LDGV category = Total Weekend Employee Miles per Year x (Weekend Employee LDGVs / Total Weekend Employee POVs)

2.1 Calculation of Annual Actual Emissions

Emission Factor (gm/mile) x Annual On-Base Mileage x 0.0022 (lb/gm) = Actual Emissions (lb/yr)

Appendix B-18
2010 Emission Calculations for Personal Vehicles
Fort Belvoir, Virginia

1.0 Data Required to Estimate Emissions from Privately Owned Vehicles (POVs)

(b) Emission Factors can be obtained from the following:
Emission factors for NOx, CO, and VOC were obtained by running EPA's MOBILE 6 model. Emission factors for PM-10, PM-2.5, and SO2 were obtained from the EPA's PART5 model, Appendix to the PART5 User's Guide.

2.0 Calculation of On-Base Mileage for Privately Owned Vehicles (POVs)

Personnel Category	Estimated Vehicles Entering Base/Year					Miles/Vehicle/ Day [3]	Total POVs per Year	Total Miles per Year
	Daily	Weekend	Annual [1]	% of Employees that drive to base	Adjusted Vehicles per year [2]			
Daily Employees	80		20,800	100%	20,800	4.00	80	83,200
Weekend Employees		80	8,320	100%	8,320	4.00	80	33,280
TOTAL (POVs)								**116,480**

(1) Estimate the annual number of vehicles entering the base per year:
e.g. Employee Vehicles/Day x 5 (day/wk) x 52 (wks/yr) + Employee Vehicles/weekend day x 2 day/month = Annual Vehicles Entering Base per Year for All Employees
(2) Estimate the adjusted vehicles per year for both the daily and weekend employees:
(3) This is the average on-base distance traveled by employees in their personal vehicles.

Appendix B-18
2010 Emission Calculations for Personal Vehicles
Fort Belvoir, Virginia

3.0 Calculation of Criteria Pollutant Emission Rates

Vehicle Category [1]	Average Vehicle Model Year [2]	Number of Vehicles	Annual On-Base Mileage	Fleet Vehicle Emission Factors (gm/mile)						Actual Emissions (lb/yr)					
				CO	VOC	NO_X	SO_X	PM-10	PM-2.5	CO	VOC	NO_X	SO_X	PM-10	PM-2.5
Privately Owned Vehicles (POVs) - Daily Employees				**1997 Average Model Year Emission Factors (Low Altitude)**											
LDGV (68.9% of Total POVs)	1997	55	57,325	14.4	0.90	0.90	0.10	0.71	0.20	1,816	115	114	12.6	89.5	25.2
LDGT12 (11.4% of Total POVs)	1997	9	9,485	16.1	1.00	1.40	0.10	1.08	0.29	336	21.1	29.2	2.09	22.5	6.05
LDGT34 (8.5% of Total POVs)	1997	7	7,072	17.6	1.10	1.80	0.10	2.58	0.66	274	17.27	28.0	1.56	40.1	10.3
HDGV (1.5% of Total POVs)	1997	1	1,248	10.2	0.70	4.50	0.20	5.51	1.42	28.0	1.94	12.36	0.55	15.1	3.90
LDDV (3.9% of Total POVs)	1997	3	3,245	1.20	0.30	1.10	0.10	0.80	0.28	8.57	2.16	7.85	0.71	5.71	2.00
LDDT (1.9% of Total POVs)	1997	2	1,581	14.5	0.50	1.30	0.20	1.59	0.48	50.4	1.75	4.52	0.70	5.53	1.67
HDDV (2.9% of Total POVs)	1997	2	2,413	2.50	0.50	16.0	0.50	7.73	2.01	13.3	2.68	84.9	2.65	41.0	10.7
MC (1% of Total POVs)	1997	1	832	16.9	2.80	1.20	0.030	0.080	0.030	30.9	5.17	2.20	0.055	0.15	0.055
Privately Owned Vehicles (POVs) - Weekend Employees															
LDGV (68.9% of Total POVs)	1997	55	22,930	14.4	0.90	0.90	0.10	0.71	0.20	726	45.8	45.4	5.04	35.8	10.1
LDGT12 (11.4% of Total POVs)	1997	9	3,794	16.1	1.00	1.40	0.10	1.08	0.29	134	8.42	11.7	0.83	9.01	2.42
LDGT34 (8.5% of Total POVs)	1997	7	2,829	17.6	1.10	1.80	0.10	2.58	0.66	110	6.91	11.2	0.62	16.1	4.11
HDGV (1.5% of Total POVs)	1997	1	499	10.2	0.70	4.50	0.20	5.51	1.42	11.2	0.78	4.94	0.22	6.05	1.56
LDDV (3.9% of Total POVs)	1997	3	1,298	1.2	0.30	1.10	0.10	0.80	0.28	3.43	0.86	3.14	0.29	2.28	0.80
LDDT (1.9% of Total POVs)	1997	2	632	14.5	0.50	1.30	0.20	1.59	0.48	20.2	0.70	1.81	0.28	2.21	0.67
HDDV (2.9% of Total POVs)	1997	2	965	2.5	0.50	16.0	0.50	7.73	2.01	5.31	1.07	34.0	1.06	16.4	4.27
MC (1% of Total POVs)	1997	1	333	16.9	2.80	1.20	0.030	0.080	0.030	12.4	2.07	0.88	0.022	0.059	0.022
TOTAL EMISSIONS (lb/yr)										**3,580**	**233**	**396**	**29.3**	**308**	**83.8**
TOTAL EMISSIONS (tpy)										**1.79**	**0.117**	**0.20**	**0.015**	**0.15**	**0.042**

(1) POVs were classified into vehicle categories based on an average on-road vehicle mix provided in AP-42, Volume II
The same average on-road mix was applied to the estimated number of Daily Employee and Weekend Employee POVs.
For example, Daily Employee POVs in LDGV category = 68.9% (LDGV/Total POVs) x Total Daily Employee POVs
Weekend Employee POVs in LDGV category = 68.9% (LDGV/Total POVs) x Total UTA Employee POVs

(2) Annual on-base mileage is for all the vehicles in a vehicle category. In the case of POVs, the annual on-base mileage is apportioned to daily employee and weekend employee vehicle categories based on the ratio of the number of vehicles in a particular category to the toal number of POVs in that employee category.
For example, Annual On-base Mileage for Daily Employee POVs in LDGV category = Total Daily Employee Miles per Year x (Daily Employee LDGVs / Total Daily Employee POVs)
Annual On-base Mileage for Weekend Employee POVs in LDGV category = Total Weekend Employee Miles per Year x (Weekend Employee LDGVs / Total Weekend Employee POVs)

2.1 Calculation of Annual Actual Emissions

Emission Factor (gm/mile) x Annual On-Base Mileage x 0.0022 (lb/gm) = Actual Emissions (lb/yr)

Appendix B-19
2011 Emission Calculations for Personal Vehicles
Fort Belvoir, Virginia

1.0 Data Required to Estimate Emissions from Privately Owned Vehicles (POVs)

(b) Emission Factors can be obtained from the following:
Emission factors for NOx, CO, and VOC were obtained by running EPA's MOBILE 6 model. Emission factors for PM-10, PM-2.5, and SO2 were obtained from the EPA's PART5 model, Appendix to the PART5 User's Guide.

2.0 Calculation of On-Base Mileage for Privately Owned Vehicles (POVs)

Personnel Category	Estimated Vehicles Entering Base/Year					Miles/Vehicle/ Day [3]	Total POVs per Year	Total Miles per Year
	Daily	Weekend	Annual [1]	% of Employees that drive to base	Adjusted Vehicles per year [2]			
Daily Employees	80		20,800	100%	20,800	4.00	80	83,200
Weekend Employees		80	8,320	100%	8,320	4.00	80	33,280
TOTAL (POVs)								**116,480**

(1) Estimate the annual number of vehicles entering the base per year:
e.g. Employee Vehicles/Day x 5 (day/wk) x 52 (wks/yr) + Employee Vehicles/weekend day x 2 day/month = Annual Vehicles Entering Base per Year for All Employees
(2) Estimate the adjusted vehicles per year for both the daily and weekend employees:
(3) This is the average on-base distance traveled by employees in their personal vehicles.

Appendix B-19
2011 Emission Calculations for Personal Vehicles
Fort Belvoir, Virginia

3.0 Calculation of Criteria Pollutant Emission Rates

Vehicle Category [1]	Average Vehicle Model Year [2]	Number of Vehicles	Annual On-Base Mileage	Fleet Vehicle Emission Factors (gm/mile)						Actual Emissions (lb/yr)					
				CO	VOC	NO_X	SO_X	PM-10	PM-2.5	CO	VOC	NO_X	SO_X	PM-10	PM-2.5
Privately Owned Vehicles (POVs) - Daily Employees				**1997 Average Model Year Emission Factors (Low Altitude)**											
LDGV (68.9% of Total POVs)	1997	55	57,325	14.4	0.90	0.90	0.10	0.71	0.20	1,816	115	114	12.6	89.5	25.2
LDGT12 (11.4% of Total POVs)	1997	9	9,485	16.1	1.00	1.40	0.10	1.08	0.29	336	21.1	29.2	2.09	22.5	6.05
LDGT34 (8.5% of Total POVs)	1997	7	7,072	17.6	1.10	1.80	0.10	2.58	0.66	274	17.3	28.0	1.56	40.1	10.3
HDGV (1.5% of Total POVs)	1997	1	1,248	10.2	0.70	4.50	0.20	5.51	1.42	28.0	1.94	12.36	0.55	15.13	3.90
LDDV (3.9% of Total POVs)	1997	3	3,245	1.20	0.30	1.10	0.10	0.80	0.28	8.57	2.16	7.85	0.71	5.71	2.00
LDDT (1.9% of Total POVs)	1997	2	1,581	14.5	0.50	1.30	0.20	1.59	0.48	50.4	1.75	4.52	0.70	5.53	1.67
HDDV (2.9% of Total POVs)	1997	2	2,413	2.50	0.50	16.0	0.50	7.73	2.01	13.3	2.68	84.9	2.65	41.0	10.7
MC (1% of Total POVs)	1997	1	832	16.9	2.80	1.20	0.030	0.080	0.030	30.9	5.17	2.20	0.055	0.15	0.055
Privately Owned Vehicles (POVs) - Weekend Employees															
LDGV (68.9% of Total POVs)	1997	55	22,930	14.4	0.90	0.90	0.10	0.71	0.20	726	45.8	45.4	5.04	35.8	10.1
LDGT12 (11.4% of Total POVs)	1997	9	3,794	16.1	1.00	1.40	0.10	1.08	0.29	134	8.42	11.7	0.83	9.01	2.42
LDGT34 (8.5% of Total POVs)	1997	7	2,829	17.6	1.10	1.80	0.10	2.58	0.66	110	6.91	11.2	0.62	16.1	4.11
HDGV (1.5% of Total POVs)	1997	1	499	10.2	0.70	4.50	0.20	5.51	1.42	11.2	0.78	4.94	0.22	6.05	1.56
LDDV (3.9% of Total POVs)	1997	3	1,298	1.2	0.30	1.10	0.10	0.80	0.28	3.43	0.86	3.14	0.29	2.28	0.80
LDDT (1.9% of Total POVs)	1997	2	632	14.5	0.50	1.30	0.20	1.59	0.48	20.2	0.70	1.81	0.28	2.21	0.67
HDDV (2.9% of Total POVs)	1997	2	965	2.5	0.50	16.0	0.50	7.73	2.01	5.31	1.07	34.0	1.06	16.4	4.27
MC (1% of Total POVs)	1997	1	333	16.9	2.80	1.20	0.030	0.080	0.030	12.4	2.07	0.88	0.022	0.059	0.022
TOTAL EMISSIONS (lb/yr)										**3,580**	**233**	**396**	**29.3**	**308**	**83.8**
TOTAL EMISSIONS (tpy)										**1.79**	**0.117**	**0.20**	**0.015**	**0.15**	**0.042**

(1) POVs were classified into vehicle categories based on an average on-road vehicle mix provided in AP-42, Volume II
The same average on-road mix was applied to the estimated number of Daily Employee and Weekend Employee POVs.
For example, Daily Employee POVs in LDGV category = 68.9% (LDGV/Total POVs) x Total Daily Employee POVs
Weekend Employee POVs in LDGV category = 68.9% (LDGV/Total POVs) x Total UTA Employee POVs

(2) Annual on-base mileage is for all the vehicles in a vehicle category. In the case of POVs, the annual on-base mileage is apportioned to daily employee and weekend employee vehicle categories based on the ratio of the number of vehicles in a particular category to the toal number of POVs in that employee category.
For example, Annual On-base Mileage for Daily Employee POVs in LDGV category = Total Daily Employee Miles per Year x (Daily Employee LDGVs / Total Daily Employee POVs)
Annual On-base Mileage for Weekend Employee POVs in LDGV category = Total Weekend Employee Miles per Year x (Weekend Employee LDGVs / Total Weekend Employee POVs)

2.1 Calculation of Annual Actual Emissions

Emission Factor (gm/mile) x Annual On-Base Mileage x 0.0022 (lb/gm) = Actual Emissions (lb/yr)

Appendix B-20
2004 Emission Calculations for Off-road Diesel Vehicles
Fort Belvoir, Virginia

1.0 Data Required to Calculate Emissions from Off Road Diesel Vehicles

(b) Emission factors are obtained from EPA's Draft June 2000 Nonroad model and EPA's Exhaust Emission Factors for Nonroad Engine Modeling-Compression -Ignition, Report No. NR-009A, Revised June 1998.

2.0 Calculation of Criteria Pollutant Emission Rates

Table 1: Emissions Estimate Based on Engine Rating and Operating Time (All Diesel-fired Equipment)

Equipment Data										*Emission Parameters*		
Vehicle/Equipment Type	Equipment Category	Engine Type	Number of Units	Engine Rating (Per Unit) (hp)	Model Year	Operating Time (Per unit) (hr/yr)	Total Operating Time (hr/yr)	Source for Operating Time	Load Factor (Percent of Max. Power)	SCC	Emission Factor Group	Brake-Specific Fuel Consumption (lb/hp-hr)
Cat 345 Trackhoe	Construction	Reciprocating	2	321	1994	0	0	Developer	55%	A2270002066	Group 3	0.433
Cat 963 Loader	Construction	Reciprocating	2	160	1994	360	720	Developer	55%	A2270002066	Group 3	0.433
Cat D6 Dozer	Construction	Reciprocating	2	165	1994	360	720	Developer	64%	A2270002069	Group 4	0.360
Cat D7 Dozer	Construction	Reciprocating	1	215	1994	360	360	Developer	64%	A2270002069	Group 4	0.360
Cat 621 Scraper (Pan)	Construction	Reciprocating	2	330	1994	360	720	Developer	72%	A2270002018	Group 4	0.433
30 ton Off-road Volvo Truck	Construction	Reciprocating	2	300	1994	360	720	Developer	57%	A2270002051	Group 3	0.433
Cat 815 Roller	Construction	Reciprocating	1	220	1994	360	360	Developer	56%	A2270002015	Group 4	0.360
950G Rubber Tire loader	Construction	Reciprocating	1	180	1994	360	360	Developer	68%	A2270002060	Group 3	0.433
Cat RS-58 Roller	Construction	Reciprocating	1	100	1994	360	360	Developer	56%	A2270002015	Group 4	0.400
Cat 345 Trackhoe	Construction	Reciprocating	2	321	1994	360	720	Developer	55%	A2270002066	Group 3	0.433
Cat 433 Roller	Construction	Reciprocating	2	92	1994	360	720	Developer	56%	A2270002015	Group 4	0.400
950G Rubber Tire loader	Construction	Reciprocating	1	180	1994	240	240	Developer	68%	A2270002060	Group 3	0.433
Cat 815 Roller	Construction	Reciprocating	1	220	1994	240	240	Developer	56%	A2270002015	Group 4	0.360
BD 90HS Paver Roller	Construction	Reciprocating	1	100	1994	240	240	Developer	56%	A2270002015	Group 4	0.400
Blawknowx PF3200 Paver	Construction	Reciprocating	1	100	1994	240	240	Developer	53%	A2270002021	Group 4	0.400
12G Motor Grader	Construction	Reciprocating	1	140	1994	240	240	Developer	61%	A2270002048	Group 4	0.360
Cat 420 Backhoe	Construction	Reciprocating	1	88	1994	240	240	Developer	55%	A2270002066	Group 3	0.481
Skid Steer Loader (Bobcat)	Construction	Reciprocating	1	48	1994	360	360	Developer	55%	A2270002072	Group 3	0.481
Cat 420 Backhoe	Construction	Reciprocating	1	88	1994	360	360	Developer	55%	A2270002066	Group 3	0.481
Cat 420 Backhoe	Construction	Reciprocating	1	88	1994	360	360	Developer	55%	A2270002066	Group 3	0.481
High Terrain Forklift	Construction	Reciprocating	3	88	1994	120	360	Developer	30%	A2270003020	Group 3	0.481
TOTAL EMISSIONS												

TOTAL EMISSIONS FROM ALL DIESEL-FIRED VEHICLE/EQUIPMENT (lb/yr)	
TOTAL EMISSIONS FROM ALL DIESEL-FIRED VEHICLE/EQUIPMENT(tpy)	

3.0 Calculation of Annual Actual Criteria Pollutant Emissions

For Table 1: Annual Actual Emissions (lb/yr) = Engine Rating (hp) x Loading Factor (%) x Operating Time per Unit (hr/yr) x Number of Units x Emission Factor (g/hp-hr) x Conversion Factor (0.002205 lb/g)

Annual Actual PM-2.5 Emissions (lb/yr) = Annual Actual PM-10 Emissions (lb/yr) x Factor for Converting PM-10 to PM-2.5

Appendix B-20
2004 Emission Calculations for Off-road Diesel Vehicles
Fort Belvoir, Virginia

1.0 Data Required to Calculate E

(b) Emission factors are obtain

2.0 Calculation of Criteria Pollut

Table 1: Emissions Estimate Ba

	Emissions Factors						*Annual Actual Emissions*					
Vehicle/Equipment Type	**VOC Emission Factor (g/hp-hr)**	**CO Emission Factor (g/hp-hr)**	**NOx Emission Factor (g/hp-hr)**	**PM-10 Emission Factor (g/hp-hr)**	**SO_2 Emission Factor (g/hp-hr)**	**Factor for PM-10 to PM-2.5 5**	**VOC Emissions (lb/yr)**	**CO Emissions (lb/yr)**	**NOx Emissions (lb/yr)**	**PM-10 Emissions (lb/yr)**	**PM-2.5 Emissions (lb/yr)**	**SO_2 Emissions (lb/yr)**
Cat 345 Trackhoe	1.5	6.2	8.6	0.8	1.26	0.92	0	0	0	0	0	0
Cat 963 Loader	1.5	6.2	8.6	0.8	1.26	0.92	210	866	1,201	112	103	176
Cat D6 Dozer	0.6	3.4	8.3	0.5	1.05	0.92	101	570	1,391	83.8	77.1	176
Cat D7 Dozer	0.6	3.4	8.3	0.5	1.05	0.92	65.5	371	907	54.6	50.2	115
Cat 621 Scraper (Pan)	1.5	6.2	8.6	0.8	1.26	0.92	566	2,339	3,244	302	278	475
30 ton Off-road Volvo Truck	1.5	6.2	8.6	0.8	1.26	0.92	407	1,683	2,335	217	200	342
Cat 815 Roller	0.6	3.4	8.3	0.5	1.05	0.92	58.7	333	812	48.9	45.0	103
950G Rubber Tire loader	1.5	6.2	8.6	0.8	1.26	0.92	146	602	836	77.7	71.5	122
Cat RS-58 Roller	0.9	4.4	8.2	0.9	1.16	0.92	40.0	196	365	40.0	36.8	51.6
Cat 345 Trackhoe	1.5	6.2	8.6	0.8	1.26	0.92	420	1,738	2,411	224	206	353
Cat 433 Roller	0.9	4.4	8.2	0.90	1.16	0.92	73.6	360	671	73.6	67.7	94.9
950G Rubber Tire loader	1.5	6.2	8.6	0.8	1.26	0.92	97.2	402	557	51.8	47.7	81.6
Cat 815 Roller	0.6	3.4	8.3	0.5	1.05	0.92	39.1	222	541	32.6	30.0	68.5
BD 90HS Paver Roller	0.9	4.4	8.2	0.9	1.16	0.92	26.7	130	243	26.7	24.5	34.4
Blawknowx PF3200 Paver	0.9	4.4	8.2	0.9	1.16	0.92	25.2	123	230	25.2	23.2	32.5
12G Motor Grader	0.6	3.4	8.3	0.5	1.05	0.92	27.1	154	375	22.6	20.8	47.5
Cat 420 Backhoe	2.2	8.1	8.5	1.5	1.40	0.92	56.3	207	218	38.4	35.3	35.9
Skid Steer Loader (Bobcat)	3.9	11.6	7.1	1.6	1.38	0.92	81.7	243	149	33.5	30.8	28.9
Cat 420 Backhoe	2.2	8.1	8.5	1.5	1.40	0.92	84.5	311	327	57.6	53.0	53.8
Cat 420 Backhoe	2.2	8.1	8.5	1.5	1.40	0.92	84.5	311	327	57.6	53.0	53.8
High Terrain Forklift	2.2	8.1	8.5	1.5	1.40	0.92	46.1	170	178	31.4	28.9	29.3
TOTAL EMISSIONS							**2,610**	**11,161**	**17,137**	**1,580**	**1,453**	**2,446**

	VOC	**CO**	**NOx**	**PM-10**	**PM-2.5**	**SO_2**
TOTAL EMISSIONS FROM ALL	**2,610**	**11,161**	**17,137**	**1,580**	**1,453**	**2,446**
TOTAL EMISSIONS FROM ALL	**1.30**	**5.58**	**8.57**	**0.79**	**0.73**	**1.22**

3.0 Calculation of Annual Actua

For Table 1: Annual Actual Emiss

Annual Actual PM-2.5 Emissions (

Appendix B-20
2004 Emission Calculations for Off-road Diesel Vehicles
Fort Belvoir, Virginia

1.0 Data Required to Calculate Emissions from Off Road Diesel Vehicles

(b) Emission factors are obtained from EPA's Draft June 2000 Nonroad model and EPA's Exhaust Emission Factors for Nonroad Engine Modeling-Compression -Ignition, Report No. NR-009A, Revised June 1998.

2.0 Calculation of Criteria Pollutant Emission Rates

Table 1: Emissions Estimate Based on Engine Rating and Operating Time (All Diesel-fired Equipment)

Equipment Data										*Emission Parameters*		
Vehicle/Equipment Type	Equipment Category	Engine Type	Number of Units	Engine Rating (Per Unit) (hp)	Model Year	Operating Time (Per unit) (hr/yr)	Total Operating Time (hr/yr)	Source for Operating Time	Load Factor (Percent of Max. Power)	SCC	Emission Factor Group	Brake-Specific Fuel Consumption (lb/hp-hr)
Cat 345 Trackhoe	Construction	Reciprocating	2	321	1994	0	0	Developer	55%	A2270002066	Group 3	0.433
Cat 963 Loader	Construction	Reciprocating	2	160	1994	360	720	Developer	55%	A2270002066	Group 3	0.433
Cat D6 Dozer	Construction	Reciprocating	2	165	1994	360	720	Developer	64%	A2270002069	Group 4	0.360
Cat D7 Dozer	Construction	Reciprocating	1	215	1994	360	360	Developer	64%	A2270002069	Group 4	0.360
Cat 621 Scraper (Pan)	Construction	Reciprocating	2	330	1994	360	720	Developer	72%	A2270002018	Group 4	0.433
30 ton Off-road Volvo Truck	Construction	Reciprocating	2	300	1994	360	720	Developer	57%	A2270002051	Group 3	0.433
Cat 815 Roller	Construction	Reciprocating	1	220	1994	360	360	Developer	56%	A2270002015	Group 4	0.360
950G Rubber Tire loader	Construction	Reciprocating	1	180	1994	360	360	Developer	68%	A2270002060	Group 3	0.433
Cat RS-58 Roller	Construction	Reciprocating	1	100	1994	360	360	Developer	56%	A2270002015	Group 4	0.400
Cat 345 Trackhoe	Construction	Reciprocating	2	321	1994	360	720	Developer	55%	A2270002066	Group 3	0.433
Cat 433 Roller	Construction	Reciprocating	2	92	1994	360	720	Developer	56%	A2270002015	Group 4	0.400
950G Rubber Tire loader	Construction	Reciprocating	1	180	1994	240	240	Developer	68%	A2270002060	Group 3	0.433
Cat 815 Roller	Construction	Reciprocating	1	220	1994	240	240	Developer	56%	A2270002015	Group 4	0.360
BD 90HS Paver Roller	Construction	Reciprocating	1	100	1994	240	240	Developer	56%	A2270002015	Group 4	0.400
Blawknowx PF3200 Paver	Construction	Reciprocating	1	100	1994	240	240	Developer	53%	A2270002021	Group 4	0.400
12G Motor Grader	Construction	Reciprocating	1	140	1994	240	240	Developer	61%	A2270002048	Group 4	0.360
Cat 420 Backhoe	Construction	Reciprocating	1	88	1994	240	240	Developer	55%	A2270002066	Group 3	0.481
Skid Steer Loader (Bobcat)	Construction	Reciprocating	1	48	1994	360	360	Developer	55%	A2270002072	Group 3	0.481
Cat 420 Backhoe	Construction	Reciprocating	1	88	1994	360	360	Developer	55%	A2270002066	Group 3	0.481
Cat 420 Backhoe	Construction	Reciprocating	1	88	1994	360	360	Developer	55%	A2270002066	Group 3	0.481
High Terrain Forklift	Construction	Reciprocating	3	88	1994	120	360	Developer	30%	A2270003020	Group 3	0.481
TOTAL EMISSIONS												

TOTAL EMISSIONS FROM ALL DIESEL-FIRED VEHICLE/EQUIPMENT (lb/yr)	
TOTAL EMISSIONS FROM ALL DIESEL-FIRED VEHICLE/EQUIPMENT(tpy)	

3.0 Calculation of Annual Actual Criteria Pollutant Emissions

For Table 1: Annual Actual Emissions (lb/yr) = Engine Rating (hp) x Loading Factor (%) x Operating Time per Unit (hr/yr) x Number of Units x Emission Factor (g/hp-hr) x Conversion Factor (0.002205 lb/g)

Annual Actual PM-2.5 Emissions (lb/yr) = Annual Actual PM-10 Emissions (lb/yr) x Factor for Converting PM-10 to PM-2.5

Appendix B-20
2004 Emission Calculations for Off-road Diesel Vehicles
Fort Belvoir, Virginia

1.0 Data Required to Calculate E

(b) Emission factors are obtain

2.0 Calculation of Criteria Pollut

Table 1: Emissions Estimate Ba

	Emissions Factors						*Annual Actual Emissions*					
Vehicle/Equipment Type	**VOC Emission Factor (g/hp-hr)**	**CO Emission Factor (g/hp-hr)**	**NOx Emission Factor (g/hp-hr)**	**PM-10 Emission Factor (g/hp-hr)**	**SO_2 Emission Factor (g/hp-hr)**	**Factor for PM-10 to PM-2.5 5**	**VOC Emissions (lb/yr)**	**CO Emissions (lb/yr)**	**NOx Emissions (lb/yr)**	**PM-10 Emissions (lb/yr)**	**PM-2.5 Emissions (lb/yr)**	**SO_2 Emissions (lb/yr)**
Cat 345 Trackhoe	1.5	6.2	8.6	0.8	1.26	0.92	0	0	0	0	0	0
Cat 963 Loader	1.5	6.2	8.6	0.8	1.26	0.92	210	866	1,201	112	103	176
Cat D6 Dozer	0.6	3.4	8.3	0.5	1.05	0.92	101	570	1,391	83.8	77.1	176
Cat D7 Dozer	0.6	3.4	8.3	0.5	1.05	0.92	65.5	371	907	54.6	50.2	115
Cat 621 Scraper (Pan)	1.5	6.2	8.6	0.8	1.26	0.92	566	2,339	3,244	302	278	475
30 ton Off-road Volvo Truck	1.5	6.2	8.6	0.8	1.26	0.92	407	1,683	2,335	217	200	342
Cat 815 Roller	0.6	3.4	8.3	0.5	1.05	0.92	58.7	333	812	48.9	45.0	103
950G Rubber Tire loader	1.5	6.2	8.6	0.8	1.26	0.92	146	602	836	77.7	71.5	122
Cat RS-58 Roller	0.9	4.4	8.2	0.9	1.16	0.92	40.0	196	365	40.0	36.8	51.6
Cat 345 Trackhoe	1.5	6.2	8.6	0.8	1.26	0.92	420	1,738	2,411	224	206	353
Cat 433 Roller	0.9	4.4	8.2	0.90	1.16	0.92	73.6	360	671	73.6	67.7	94.9
950G Rubber Tire loader	1.5	6.2	8.6	0.8	1.26	0.92	97.2	402	557	51.8	47.7	81.6
Cat 815 Roller	0.6	3.4	8.3	0.5	1.05	0.92	39.1	222	541	32.6	30.0	68.5
BD 90HS Paver Roller	0.9	4.4	8.2	0.9	1.16	0.92	26.7	130	243	26.7	24.5	34.4
Blawknowx PF3200 Paver	0.9	4.4	8.2	0.9	1.16	0.92	25.2	123	230	25.2	23.2	32.5
12G Motor Grader	0.6	3.4	8.3	0.5	1.05	0.92	27.1	154	375	22.6	20.8	47.5
Cat 420 Backhoe	2.2	8.1	8.5	1.5	1.40	0.92	56.3	207	218	38.4	35.3	35.9
Skid Steer Loader (Bobcat)	3.9	11.6	7.1	1.6	1.38	0.92	81.7	243	149	33.5	30.8	28.9
Cat 420 Backhoe	2.2	8.1	8.5	1.5	1.40	0.92	84.5	311	327	57.6	53.0	53.8
Cat 420 Backhoe	2.2	8.1	8.5	1.5	1.40	0.92	84.5	311	327	57.6	53.0	53.8
High Terrain Forklift	2.2	8.1	8.5	1.5	1.40	0.92	46.1	170	178	31.4	28.9	29.3
TOTAL EMISSIONS							**2,610**	**11,161**	**17,137**	**1,580**	**1,453**	**2,446**

	VOC	**CO**	**NOx**	**PM-10**	**PM-2.5**	**SO_2**
TOTAL EMISSIONS FROM ALL	**2,610**	**11,161**	**17,137**	**1,580**	**1,453**	**2,446**
TOTAL EMISSIONS FROM ALL	**1.30**	**5.58**	**8.57**	**0.79**	**0.73**	**1.22**

3.0 Calculation of Annual Actua

For Table 1: Annual Actual Emiss

Annual Actual PM-2.5 Emissions (

Appendix B-21
2005 Emission Calculations for Off-road Diesel Vehicles
Fort Belvoir, Virginia

1.0 Data Required to Calculate Emissions from Off Road Diesel Vehicles

(b) Emission factors are obtained from EPA's Draft June 2000 Nonroad model and EPA's Exhaust Emission Factors for Nonroad Engine Modeling-Compression -Ignition, Report No. NR-009A, Revised June 1998.

2.0 Calculation of Criteria Pollutant Emission Rates

Table 1: Emissions Estimate Based on Engine Rating and Operating Time (All Diesel-fired Equipment)

Equipment Data										*Emission Parameters*		
Vehicle/Equipment Type	Equipment Category	Engine Type	Number of Units	Engine Rating (Per Unit) (hp)	Model Year	Operating Time (Per unit) (hr/yr)	Total Operating Time (hr/yr)	Source for Operating Time	Load Factor (Percent of Max. Power)	SCC	Emission Factor Group	Brake-Specific Fuel Consumption (lb/hp-hr)
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Cat 963 Loader	Construction	Reciprocating	2	160	1994	360	720	Developer	55%	A2270002066	Group 3	0.433
Cat D6 Dozer	Construction	Reciprocating	2	165	1994	360	720	Developer	64%	A2270002069	Group 4	0.360
Cat D7 Dozer	Construction	Reciprocating	1	215	1994	360	360	Developer	64%	A2270002069	Group 4	0.360
Cat 621 Scraper (Pan)	Construction	Reciprocating	2	330	1994	360	720	Developer	72%	A2270002018	Group 4	0.433
30 ton Off-road Volvo Truck	Construction	Reciprocating	2	300	1994	360	720	Developer	57%	A2270002051	Group 3	0.433
Cat 815 Roller	Construction	Reciprocating	1	220	1994	360	360	Developer	56%	A2270002015	Group 4	0.360
950G Rubber Tire loader	Construction	Reciprocating	1	180	1994	480	480	Developer	68%	A2270002060	Group 3	0.433
Cat RS-58 Roller	Construction	Reciprocating	1	100	1994	480	480	Developer	56%	A2270002015	Group 4	0.400
Cat 345 Trackhoe	Construction	Reciprocating	2	321	1994	480	960	Developer	55%	A2270002066	Group 3	0.433
Cat 433 Roller	Construction	Reciprocating	2	92	1994	480	960	Developer	56%	A2270002015	Group 4	0.400
950G Rubber Tire loader	Construction	Reciprocating	1	180	1994	480	480	Developer	68%	A2270002060	Group 3	0.433
Cat 815 Roller	Construction	Reciprocating	1	220	1994	480	480	Developer	56%	A2270002015	Group 4	0.360
BD 90HS Paver Roller	Construction	Reciprocating	1	100	1994	480	480	Developer	56%	A2270002015	Group 4	0.400
Blawknowx PF3200 Paver	Construction	Reciprocating	1	100	1994	480	480	Developer	53%	A2270002021	Group 4	0.400
12G Motor Grader	Construction	Reciprocating	1	140	1994	480	480	Developer	61%	A2270002048	Group 4	0.360
Cat 420 Backhoe	Construction	Reciprocating	1	88	1994	480	480	Developer	55%	A2270002066	Group 3	0.481
Skid Steer Loader (Bobcat)	Construction	Reciprocating	1	48	1994	1,440	1,440	Developer	55%	A2270002072	Group 3	0.481
Cat 420 Backhoe	Construction	Reciprocating	1	88	1994	1,440	1,440	Developer	55%	A2270002066	Group 3	0.481
Cat 420 Backhoe	Construction	Reciprocating	1	88	1994	1,440	1,440	Developer	55%	A2270002066	Group 3	0.481
High Terrain Forklift	Construction	Reciprocating	3	88	1994	1,440	4,320	Developer	30%	A2270003020	Group 3	0.481
TOTAL EMISSIONS												

TOTAL EMISSIONS FROM ALL DIESEL-FIRED VEHICLE/EQUIPMENT (lb/yr)
TOTAL EMISSIONS FROM ALL DIESEL-FIRED VEHICLE/EQUIPMENT(tpy)

3.0 Calculation of Annual Actual Criteria Pollutant Emissions

For Table 1: Annual Actual Emissions (lb/yr) = Engine Rating (hp) x Loading Factor (%) x Operating Time per Unit (hr/yr) x Number of Units x Emission Factor (g/hp-hr) x Conversion Factor (0.002205 lb/g)

Annual Actual PM-2.5 Emissions (lb/yr) = Annual Actual PM-10 Emissions (lb/yr) x Factor for Converting PM-10 to PM-2.5

Appendix B-21
2005 Emission Calculations for Off-road Diesel Vehicles
Fort Belvoir, Virginia

1.0 Data Required to Calculate I

(b) Emission factors are obtain

2.0 Calculation of Criteria Pollu

Table 1: Emissions Estimate B

	Emissions Factors						*Annual Actual Emissions*					
Vehicle/Equipment Type	**VOC Emission Factor (g/hp-hr)**	**CO Emission Factor (g/hp-hr)**	**NOx Emission Factor (g/hp-hr)**	**PM-10 Emission Factor (g/hp-hr)**	**SO_2 Emission Factor (g/hp-hr)**	**Factor for PM-10 to PM-2.5 5**	**VOC Emissions (lb/yr)**	**CO Emissions (lb/yr)**	**NOx Emissions (lb/yr)**	**PM-10 Emissions (lb/yr)**	**PM-2.5 Emissions (lb/yr)**	**SO_2 Emissions (lb/yr)**
Cat 345 Trackhoe	1.5	6.2	8.6	0.8	1.26	0.92	1,261	5,213	7,232	673	619	1,059
Cat 963 Loader	1.5	6.2	8.6	0.8	1.26	0.92	210	866	1,201	112	103	176
Cat D6 Dozer	0.6	3.4	8.3	0.5	1.05	0.92	101	570	1,391	83.8	77.1	176
Cat D7 Dozer	0.6	3.4	8.3	0.5	1.05	0.92	65.5	371	907	54.6	50.2	115
Cat 621 Scraper (Pan)	1.5	6.2	8.6	0.8	1.26	0.92	566	2,339	3,244	302	278	475
30 ton Off-road Volvo Truck	1.5	6.2	8.6	0.8	1.26	0.92	407	1,683	2,335	217	200	342
Cat 815 Roller	0.6	3.4	8.3	0.5	1.05	0.92	58.7	333	812	48.9	45.0	103
950G Rubber Tire loader	1.5	6.2	8.6	0.8	1.26	0.92	194	803	1,114	104	95.3	163
Cat RS-58 Roller	0.9	4.4	8.2	0.9	1.16	0.92	53.3	261	486	53.3	49.1	68.8
Cat 345 Trackhoe	1.5	6.2	8.6	0.8	1.26	0.92	561	2,317	3,214	299.0	275	471
Cat 433 Roller	0.9	4.4	8.2	0.90	1.16	0.92	98.2	480	894	98.2	90.3	127
950G Rubber Tire loader	1.5	6.2	8.6	0.8	1.26	0.92	194	803	1,114	104	95.3	163
Cat 815 Roller	0.6	3.4	8.3	0.5	1.05	0.92	78.2	443	1,082	65.2	60.0	137
BD 90HS Paver Roller	0.9	4.4	8.2	0.9	1.16	0.92	53.3	261	486	53.3	49.1	68.8
Blawknowx PF3200 Paver	0.9	4.4	8.2	0.9	1.16	0.92	50.5	247	460	50.5	46.4	65.1
12G Motor Grader	0.6	3.4	8.3	0.5	1.05	0.92	54.2	307	750	45.2	41.6	94.9
Cat 420 Backhoe	2.2	8.1	8.5	1.5	1.40	0.92	113	415	435	76.8	70.7	71.7
Skid Steer Loader (Bobcat)	3.9	11.6	7.1	1.6	1.38	0.92	327	972	595	134	123	116
Cat 420 Backhoe	2.2	8.1	8.5	1.5	1.40	0.92	338	1,245	1,306	231	212	215
Cat 420 Backhoe	2.2	8.1	8.5	1.5	1.40	0.92	338	1,245	1,306	231	212	215
High Terrain Forklift	2.2	8.1	8.5	1.5	1.40	0.92	553	2,037	2,138	377	347	352
TOTAL EMISSIONS							**3,860**	**15,961**	**23,134**	**2,362**	**2,173**	**3,363**

	VOC	CO	NOx	PM-10	PM-2.5	SO_2
TOTAL EMISSIONS FROM ALL	**3,860**	**15,961**	**23,134**	**2,362**	**2,173**	**3,363**
TOTAL EMISSIONS FROM ALL	**1.93**	**7.98**	**11.6**	**1.18**	**1.09**	**1.68**

3.0 Calculation of Annual Actua

For Table 1: Annual Actual Emiss

Annual Actual PM-2.5 Emissions

Appendix B-22
2006 Emission Calculations for Off-road Diesel Vehicles
Fort Belvoir, Virginia

1.0 Data Required to Calculate Emissions from Off Road Diesel Vehicles

(b) Emission factors are obtained from EPA's Draft June 2000 Nonroad model and EPA's Exhaust Emission Factors for Nonroad Engine Modeling-Compression -Ignition, Report No. NR-009A, Revised June 1998.

2.0 Calculation of Criteria Pollutant Emission Rates

Table 1: Emissions Estimate Based on Engine Rating and Operating Time (All Diesel-fired Equipment)

Equipment Data										*Emission Parameters*		
Vehicle/Equipment Type	Equipment Category	Engine Type	Number of Units	Engine Rating (Per Unit) (hp)	Model Year	Operating Time (Per unit) (hr/yr)	Total Operating Time (hr/yr)	Source for Operating Time	Load Factor (Percent of Max. Power)	SCC	Emission Factor Group	Brake-Specific Fuel Consumption (lb/hp-hr)
Cat 345 Trackhoe	Construction	Reciprocating	2	321	1994	1,240	2,480	Developer	55%	A2270002066	Group 3	0.433
Cat 963 Loader	Construction	Reciprocating	2	160	1994	720	1,440	Developer	55%	A2270002066	Group 3	0.433
Cat D6 Dozer	Construction	Reciprocating	2	165	1994	720	1,440	Developer	64%	A2270002069	Group 4	0.360
Cat D7 Dozer	Construction	Reciprocating	1	215	1994	720	720	Developer	64%	A2270002069	Group 4	0.360
Cat 621 Scraper (Pan)	Construction	Reciprocating	2	330	1994	720	1,440	Developer	72%	A2270002018	Group 4	0.433
30 ton Off-road Volvo Truck	Construction	Reciprocating	2	300	1994	720	1,440	Developer	57%	A2270002051	Group 3	0.433
Cat 815 Roller	Construction	Reciprocating	1	220	1994	720	720	Developer	56%	A2270002015	Group 4	0.360
950G Rubber Tire loader	Construction	Reciprocating	1	180	1994	480	480	Developer	68%	A2270002060	Group 3	0.433
Cat RS-58 Roller	Construction	Reciprocating	1	100	1994	480	480	Developer	56%	A2270002015	Group 4	0.400
Cat 345 Trackhoe	Construction	Reciprocating	2	321	1994	480	960	Developer	55%	A2270002066	Group 3	0.433
Cat 433 Roller	Construction	Reciprocating	2	92	1994	480	960	Developer	56%	A2270002015	Group 4	0.400
950G Rubber Tire loader	Construction	Reciprocating	1	180	1994	480	480	Developer	68%	A2270002060	Group 3	0.433
Cat 815 Roller	Construction	Reciprocating	1	220	1994	480	480	Developer	56%	A2270002015	Group 4	0.360
BD 90HS Paver Roller	Construction	Reciprocating	1	100	1994	480	480	Developer	56%	A2270002015	Group 4	0.400
Blawknowx PF3200 Paver	Construction	Reciprocating	1	100	1994	480	480	Developer	53%	A2270002021	Group 4	0.400
12G Motor Grader	Construction	Reciprocating	1	140	1994	480	480	Developer	61%	A2270002048	Group 4	0.360
Cat 420 Backhoe	Construction	Reciprocating	1	88	1994	480	480	Developer	55%	A2270002066	Group 3	0.481
Skid Steer Loader (Bobcat)	Construction	Reciprocating	1	48	1994	1,440	1,440	Developer	55%	A2270002072	Group 3	0.481
Cat 420 Backhoe	Construction	Reciprocating	1	88	1994	1,440	1,440	Developer	55%	A2270002066	Group 3	0.481
Cat 420 Backhoe	Construction	Reciprocating	1	88	1994	1,440	1,440	Developer	55%	A2270002066	Group 3	0.481
High Terrain Forklift	Construction	Reciprocating	3	88	1994	1,440	4,320	Developer	30%	A2270003020	Group 3	0.481
TOTAL EMISSIONS												

TOTAL EMISSIONS FROM ALL DIESEL-FIRED VEHICLE/EQUIPMENT (lb/yr)
TOTAL EMISSIONS FROM ALL DIESEL-FIRED VEHICLE/EQUIPMENT(tpy)

3.0 Calculation of Annual Actual Criteria Pollutant Emissions

For Table 1: Annual Actual Emissions (lb/yr) = Engine Rating (hp) x Loading Factor (%) x Operating Time per Unit (hr/yr) x Number of Units x Emission Factor (g/hp-hr) x Conversion Factor (0.002205 lb/g)

Annual Actual PM-2.5 Emissions (lb/yr) = Annual Actual PM-10 Emissions (lb/yr) x Factor for Converting PM-10 to PM-2.5

Appendix B-22
2006 Emission Calculations for Off-road Diesel Vehicles
Fort Belvoir, Virginia

1.0 Data Required to Calculate I

(b) Emission factors are obtain

2.0 Calculation of Criteria Pollu

Table 1: Emissions Estimate B

	Emissions Factors						*Annual Actual Emissions*					
Vehicle/Equipment Type	**VOC Emission Factor (g/hp-hr)**	**CO Emission Factor (g/hp-hr)**	**NOx Emission Factor (g/hp-hr)**	**PM-10 Emission Factor (g/hp-hr)**	**SO_2 Emission Factor (g/hp-hr)**	**Factor for PM-10 to PM-2.5 5**	**VOC Emissions (lb/yr)**	**CO Emissions (lb/yr)**	**NOx Emissions (lb/yr)**	**PM-10 Emissions (lb/yr)**	**PM-2.5 Emissions (lb/yr)**	**SO_2 Emissions (lb/yr)**
Cat 345 Trackhoe	1.5	6.2	8.6	0.8	1.26	0.92	1,448	5,986	8,303	772	711	1,216
Cat 963 Loader	1.5	6.2	8.6	0.8	1.26	0.92	419	1,732	2,403	224	206	352
Cat D6 Dozer	0.6	3.4	8.3	0.5	1.05	0.92	201	1,140	2,783	168	154	352
Cat D7 Dozer	0.6	3.4	8.3	0.5	1.05	0.92	131	743	1,813	109	100	229
Cat 621 Scraper (Pan)	1.5	6.2	8.6	0.8	1.26	0.92	1,132	4,677	6,488	604	555	951
30 ton Off-road Volvo Truck	1.5	6.2	8.6	0.8	1.26	0.92	814	3,366	4,669	434	400	684
Cat 815 Roller	0.6	3.4	8.3	0.5	1.05	0.92	117	665	1,623	97.8	90.0	205
950G Rubber Tire loader	1.5	6.2	8.6	0.8	1.26	0.92	194	803	1,114	104	95.3	163
Cat RS-58 Roller	0.9	4.4	8.2	0.9	1.16	0.92	53.3	261	486	53.3	49.1	69
Cat 345 Trackhoe	1.5	6.2	8.6	0.8	1.26	0.92	561	2,317	3,214	299	275	471
Cat 433 Roller	0.9	4.4	8.2	0.90	1.16	0.92	98.2	480	894	98.2	90.3	127
950G Rubber Tire loader	1.5	6.2	8.6	0.8	1.26	0.92	194	803	1,114	104	95.3	163
Cat 815 Roller	0.6	3.4	8.3	0.5	1.05	0.92	78.2	443	1,082	65.2	60.0	137
BD 90HS Paver Roller	0.9	4.4	8.2	0.9	1.16	0.92	53.3	261	486	53.3	49.1	68.8
Blawknowx PF3200 Paver	0.9	4.4	8.2	0.9	1.16	0.92	50.5	247	460	50.5	46.4	65.1
12G Motor Grader	0.6	3.4	8.3	0.5	1.05	0.92	54.2	307	750	45.2	41.6	94.9
Cat 420 Backhoe	2.2	8.1	8.5	1.5	1.40	0.92	113	415	435	76.8	70.7	71.7
Skid Steer Loader (Bobcat)	3.9	11.6	7.1	1.6	1.38	0.92	327	972	595	134	123	116
Cat 420 Backhoe	2.2	8.1	8.5	1.5	1.40	0.92	338	1,245	1,306	231	212	215
Cat 420 Backhoe	2.2	8.1	8.5	1.5	1.40	0.92	338	1,245	1,306	231	212	215
High Terrain Forklift	2.2	8.1	8.5	1.5	1.40	0.92	553	2,037	2,138	377	347	352
TOTAL EMISSIONS							**5,268**	**22,123**	**33,024**	**3,180**	**2,926**	**4,750**

	VOC	CO	NOx	PM-10	PM-2.5	SO_2
TOTAL EMISSIONS FROM ALL	**5,268**	**22,123**	**33,024**	**3,180**	**2,926**	**4,750**
TOTAL EMISSIONS FROM ALL	**2.63**	**11.1**	**16.5**	**1.59**	**1.46**	**2.37**

3.0 Calculation of Annual Actua

For Table 1: Annual Actual Emiss

Annual Actual PM-2.5 Emissions

Appendix B-23
2007 Emission Calculations for Off-road Diesel Vehicles
Fort Belvoir, Virginia

1.0 Data Required to Calculate Emissions from Off Road Diesel Vehicles

(b) Emission factors are obtained from EPA's Draft June 2000 Nonroad model and EPA's Exhaust Emission Factors for Nonroad Engine Modeling-Compression -Ignition, Report No. NR-009A, Revised June 1998.

2.0 Calculation of Criteria Pollutant Emission Rates

Table 1: Emissions Estimate Based on Engine Rating and Operating Time (All Diesel-fired Equipment)

Equipment Data										*Emission Parameters*		
Vehicle/Equipment Type	Equipment Category	Engine Type	Number of Units	Engine Rating (Per Unit) (hp)	Model Year	Operating Time (Per unit) (hr/yr)	Total Operating Time (hr/yr)	Source for Operating Time	Load Factor (Percent of Max. Power)	SCC	Emission Factor Group	Brake-Specific Fuel Consumption (lb/hp-hr)
Cat 345 Trackhoe	Construction	Reciprocating	2	321	1994	920	1,840	Developer	55%	A2270002066	Group 3	0.433
Cat 963 Loader	Construction	Reciprocating	2	160	1994	600	1,200	Developer	55%	A2270002066	Group 3	0.433
Cat D6 Dozer	Construction	Reciprocating	2	165	1994	600	1,200	Developer	64%	A2270002069	Group 4	0.360
Cat D7 Dozer	Construction	Reciprocating	1	215	1994	600	600	Developer	64%	A2270002069	Group 4	0.360
Cat 621 Scraper (Pan)	Construction	Reciprocating	2	330	1994	600	1,200	Developer	72%	A2270002018	Group 4	0.433
30 ton Off-road Volvo Truck	Construction	Reciprocating	2	300	1994	600	1,200	Developer	57%	A2270002051	Group 3	0.433
Cat 815 Roller	Construction	Reciprocating	1	220	1994	600	600	Developer	56%	A2270002015	Group 4	0.360
950G Rubber Tire loader	Construction	Reciprocating	1	180	1994	720	720	Developer	68%	A2270002060	Group 3	0.433
Cat RS-58 Roller	Construction	Reciprocating	1	100	1994	720	720	Developer	56%	A2270002015	Group 4	0.400
Cat 345 Trackhoe	Construction	Reciprocating	2	321	1994	720	1,440	Developer	55%	A2270002066	Group 3	0.433
Cat 433 Roller	Construction	Reciprocating	2	92	1994	720	1,440	Developer	56%	A2270002015	Group 4	0.400
950G Rubber Tire loader	Construction	Reciprocating	1	180	1994	720	720	Developer	68%	A2270002060	Group 3	0.433
Cat 815 Roller	Construction	Reciprocating	1	220	1994	720	720	Developer	56%	A2270002015	Group 4	0.360
BD 90HS Paver Roller	Construction	Reciprocating	1	100	1994	720	720	Developer	56%	A2270002015	Group 4	0.400
Blawknowx PF3200 Paver	Construction	Reciprocating	1	100	1994	720	720	Developer	53%	A2270002021	Group 4	0.400
12G Motor Grader	Construction	Reciprocating	1	140	1994	720	720	Developer	61%	A2270002048	Group 4	0.360
Cat 420 Backhoe	Construction	Reciprocating	1	88	1994	720	720	Developer	55%	A2270002066	Group 3	0.481
Skid Steer Loader (Bobcat)	Construction	Reciprocating	1	48	1994	1,440	1,440	Developer	55%	A2270002072	Group 3	0.481
Cat 420 Backhoe	Construction	Reciprocating	1	88	1994	1,440	1,440	Developer	55%	A2270002066	Group 3	0.481
Cat 420 Backhoe	Construction	Reciprocating	1	88	1994	1,440	1,440	Developer	55%	A2270002066	Group 3	0.481
High Terrain Forklift	Construction	Reciprocating	3	88	1994	1,440	4,320	Developer	30%	A2270003020	Group 3	0.481
TOTAL EMISSIONS												

TOTAL EMISSIONS FROM ALL DIESEL-FIRED VEHICLE/EQUIPMENT (lb/yr)
TOTAL EMISSIONS FROM ALL DIESEL-FIRED VEHICLE/EQUIPMENT(tpy)

3.0 Calculation of Annual Actual Criteria Pollutant Emissions

For Table 1: Annual Actual Emissions (lb/yr) = Engine Rating (hp) x Loading Factor (%) x Operating Time per Unit (hr/yr) x Number of Units x Emission Factor (g/hp-hr) x Conversion Factor (0.002205 lb/g)

Annual Actual PM-2.5 Emissions (lb/yr) = Annual Actual PM-10 Emissions (lb/yr) x Factor for Converting PM-10 to PM-2.5

Appendix B-23
2007 Emission Calculations for Off-road Diesel Vehicles
Fort Belvoir, Virginia

1.0 Data Required to Calculate I

(b) Emission factors are obtain

2.0 Calculation of Criteria Pollu

Table 1: Emissions Estimate B

	Emissions Factors						*Annual Actual Emissions*					
Vehicle/Equipment Type	**VOC Emission Factor (g/hp-hr)**	**CO Emission Factor (g/hp-hr)**	**NOx Emission Factor (g/hp-hr)**	**PM-10 Emission Factor (g/hp-hr)**	**SO_2 Emission Factor (g/hp-hr)**	**Factor for PM-10 to PM-2.5 5**	**VOC Emissions (lb/yr)**	**CO Emissions (lb/yr)**	**NOx Emissions (lb/yr)**	**PM-10 Emissions (lb/yr)**	**PM-2.5 Emissions (lb/yr)**	**SO_2 Emissions (lb/yr)**
Cat 345 Trackhoe	1.5	6.2	8.6	0.8	1.26	0.92	1,074	4,441	6,160	573	527	903
Cat 963 Loader	1.5	6.2	8.6	0.8	1.26	0.92	349	1,444	2,002	186	171	293
Cat D6 Dozer	0.6	3.4	8.3	0.5	1.05	0.92	168	950	2,319	140	129	293
Cat D7 Dozer	0.6	3.4	8.3	0.5	1.05	0.92	109	619	1,511	91.0	83.7	191
Cat 621 Scraper (Pan)	1.5	6.2	8.6	0.8	1.26	0.92	943	3,898	5,407	503	463	792
30 ton Off-road Volvo Truck	1.5	6.2	8.6	0.8	1.26	0.92	679	2,805	3,891	362	333	570
Cat 815 Roller	0.6	3.4	8.3	0.5	1.05	0.92	97.8	554	1,353	81.5	75.0	171
950G Rubber Tire loader	1.5	6.2	8.6	0.8	1.26	0.92	291	1,205	1,671	155	143	245
Cat RS-58 Roller	0.9	4.4	8.2	0.9	1.16	0.92	80.0	391	729	80.0	73.6	103
Cat 345 Trackhoe	1.5	6.2	8.6	0.8	1.26	0.92	841	3,476	4,821	448	413	706
Cat 433 Roller	0.9	4.4	8.2	0.90	1.16	0.92	147	720	1,341	147	135	190
950G Rubber Tire loader	1.5	6.2	8.6	0.8	1.26	0.92	291	1,205	1,671	155	143	245
Cat 815 Roller	0.6	3.4	8.3	0.5	1.05	0.92	117	665	1,623	97.8	90.0	205
BD 90HS Paver Roller	0.9	4.4	8.2	0.9	1.16	0.92	80.0	391	729	80.0	73.6	103
Blawknowx PF3200 Paver	0.9	4.4	8.2	0.9	1.16	0.92	75.7	370	690	75.7	69.7	97.6
12G Motor Grader	0.6	3.4	8.3	0.5	1.05	0.92	81.3	461	1,125	67.8	62.4	142
Cat 420 Backhoe	2.2	8.1	8.5	1.5	1.40	0.92	169	622	653	115	106	108
Skid Steer Loader (Bobcat)	3.9	11.6	7.1	1.6	1.38	0.92	327	972	595	134	123	116
Cat 420 Backhoe	2.2	8.1	8.5	1.5	1.40	0.92	338	1,245	1,306	231	212	215
Cat 420 Backhoe	2.2	8.1	8.5	1.5	1.40	0.92	338	1,245	1,306	231	212	215
High Terrain Forklift	2.2	8.1	8.5	1.5	1.40	0.92	553	2,037	2,138	377	347	352
TOTAL EMISSIONS							**5,523**	**23,238**	**34,746**	**3,382**	**3,111**	**5,002**

	VOC	CO	NOx	PM-10	PM-2.5	SO_2
TOTAL EMISSIONS FROM ALL	**5,523**	**23,238**	**34,746**	**3,382**	**3,111**	**5,002**
TOTAL EMISSIONS FROM ALL	**2.76**	**11.6**	**17.4**	**1.69**	**1.56**	**2.50**

3.0 Calculation of Annual Actua

For Table 1: Annual Actual Emiss

Annual Actual PM-2.5 Emissions

Appendix B-24
2008 Emission Calculations for Off-road Diesel Vehicles
Fort Belvoir, Virginia

1.0 Data Required to Calculate Emissions from Off Road Diesel Vehicles

(b) Emission factors are obtained from EPA's Draft June 2000 Nonroad model and EPA's Exhaust Emission Factors for Nonroad Engine Modeling-Compression -Ignition, Report No. NR-009A, Revised June 1998.

2.0 Calculation of Criteria Pollutant Emission Rates

Table 1: Emissions Estimate Based on Engine Rating and Operating Time (All Diesel-fired Equipment)

Equipment Data										*Emission Parameters*		
Vehicle/Equipment Type	Equipment Category	Engine Type	Number of Units	Engine Rating (Per Unit) (hp)	Model Year	Operating Time (Per unit) (hr/yr)	Total Operating Time (hr/yr)	Source for Operating Time	Load Factor (Percent of Max. Power)	SCC	Emission Factor Group	Brake-Specific Fuel Consumption (lb/hp-hr)
Cat 345 Trackhoe	Construction	Reciprocating	2	321	1994	400	800	Developer	55%	A2270002066	Group 3	0.433
Cat 963 Loader	Construction	Reciprocating	2	160	1994	600	1,200	Developer	55%	A2270002066	Group 3	0.433
Cat D6 Dozer	Construction	Reciprocating	2	165	1994	600	1,200	Developer	64%	A2270002069	Group 4	0.360
Cat D7 Dozer	Construction	Reciprocating	1	215	1994	600	600	Developer	64%	A2270002069	Group 4	0.360
Cat 621 Scraper (Pan)	Construction	Reciprocating	2	330	1994	600	1,200	Developer	72%	A2270002018	Group 4	0.433
30 ton Off-road Volvo Truck	Construction	Reciprocating	2	300	1994	600	1,200	Developer	57%	A2270002051	Group 3	0.433
Cat 815 Roller	Construction	Reciprocating	1	220	1994	600	600	Developer	56%	A2270002015	Group 4	0.360
950G Rubber Tire loader	Construction	Reciprocating	1	180	1994	600	600	Developer	68%	A2270002060	Group 3	0.433
Cat RS-58 Roller	Construction	Reciprocating	1	100	1994	600	600	Developer	56%	A2270002015	Group 4	0.400
Cat 345 Trackhoe	Construction	Reciprocating	2	321	1994	600	1,200	Developer	55%	A2270002066	Group 3	0.433
Cat 433 Roller	Construction	Reciprocating	2	92	1994	600	1,200	Developer	56%	A2270002015	Group 4	0.400
950G Rubber Tire loader	Construction	Reciprocating	1	180	1994	360	360	Developer	68%	A2270002060	Group 3	0.433
Cat 815 Roller	Construction	Reciprocating	1	220	1994	360	360	Developer	56%	A2270002015	Group 4	0.360
BD 90HS Paver Roller	Construction	Reciprocating	1	100	1994	360	360	Developer	56%	A2270002015	Group 4	0.400
Blawknowx PF3200 Paver	Construction	Reciprocating	1	100	1994	360	360	Developer	53%	A2270002021	Group 4	0.400
12G Motor Grader	Construction	Reciprocating	1	140	1994	360	360	Developer	61%	A2270002048	Group 4	0.360
Cat 420 Backhoe	Construction	Reciprocating	1	88	1994	360	360	Developer	55%	A2270002066	Group 3	0.481
Skid Steer Loader (Bobcat)	Construction	Reciprocating	1	48	1994	960	960	Developer	55%	A2270002072	Group 3	0.481
Cat 420 Backhoe	Construction	Reciprocating	1	88	1994	960	960	Developer	55%	A2270002066	Group 3	0.481
Cat 420 Backhoe	Construction	Reciprocating	1	88	1994	960	960	Developer	55%	A2270002066	Group 3	0.481
High Terrain Forklift	Construction	Reciprocating	3	88	1994	1,440	4,320	Developer	30%	A2270003020	Group 3	0.481
TOTAL EMISSIONS												

TOTAL EMISSIONS FROM ALL DIESEL-FIRED VEHICLE/EQUIPMENT (lb/yr)
TOTAL EMISSIONS FROM ALL DIESEL-FIRED VEHICLE/EQUIPMENT(tpy)

3.0 Calculation of Annual Actual Criteria Pollutant Emissions

For Table 1: Annual Actual Emissions (lb/yr) = Engine Rating (hp) x Loading Factor (%) x Operating Time per Unit (hr/yr) x Number of Units x Emission Factor (g/hp-hr) x Conversion Factor (0.002205 lb/g)

Annual Actual PM-2.5 Emissions (lb/yr) = Annual Actual PM-10 Emissions (lb/yr) x Factor for Converting PM-10 to PM-2.5

Appendix B-24
2008 Emission Calculations for Off-road Diesel Vehicles
Fort Belvoir, Virginia

1.0 Data Required to Calculate I

(b) Emission factors are obtain

2.0 Calculation of Criteria Pollu

Table 1: Emissions Estimate B

	Emissions Factors						*Annual Actual Emissions*					
Vehicle/Equipment Type	**VOC Emission Factor (g/hp-hr)**	**CO Emission Factor (g/hp-hr)**	**NOx Emission Factor (g/hp-hr)**	**PM-10 Emission Factor (g/hp-hr)**	**SO_2 Emission Factor (g/hp-hr)**	**Factor for PM-10 to PM-2.5 5**	**VOC Emissions (lb/yr)**	**CO Emissions (lb/yr)**	**NOx Emissions (lb/yr)**	**PM-10 Emissions (lb/yr)**	**PM-2.5 Emissions (lb/yr)**	**SO_2 Emissions (lb/yr)**
Cat 345 Trackhoe	1.5	6.2	8.6	0.8	1.26	0.92	467	1,931	2,678	249	229	392
Cat 963 Loader	1.5	6.2	8.6	0.8	1.26	0.92	349	1,444	2,002	186	171	293
Cat D6 Dozer	0.6	3.4	8.3	0.5	1.05	0.92	168	950	2,319	140	129	293
Cat D7 Dozer	0.6	3.4	8.3	0.5	1.05	0.92	109	619	1,511	91.0	83.7	191
Cat 621 Scraper (Pan)	1.5	6.2	8.6	0.8	1.26	0.92	943	3,898	5,407	503	463	792
30 ton Off-road Volvo Truck	1.5	6.2	8.6	0.8	1.26	0.92	679	2,805	3,891	362	333	570
Cat 815 Roller	0.6	3.4	8.3	0.5	1.05	0.92	97.8	554	1,353	81.5	75.0	171
950G Rubber Tire loader	1.5	6.2	8.6	0.8	1.26	0.92	243	1,004	1,393	130	119	204
Cat RS-58 Roller	0.9	4.4	8.2	0.9	1.16	0.92	66.7	326	608	66.7	61.3	85.9
Cat 345 Trackhoe	1.5	6.2	8.6	0.8	1.26	0.92	701	2,896	4,018	374	344	589
Cat 433 Roller	0.9	4.4	8.2	0.90	1.16	0.92	123	600	1,118	123	113	158
950G Rubber Tire loader	1.5	6.2	8.6	0.8	1.26	0.92	146	602	836	77.7	71.5	122
Cat 815 Roller	0.6	3.4	8.3	0.5	1.05	0.92	58.7	333	812	48.9	45.0	103
BD 90HS Paver Roller	0.9	4.4	8.2	0.9	1.16	0.92	40.0	196	365	40.0	36.8	51.6
Blawknowx PF3200 Paver	0.9	4.4	8.2	0.9	1.16	0.92	37.9	185	345	37.9	34.8	48.8
12G Motor Grader	0.6	3.4	8.3	0.5	1.05	0.92	40.7	230	563	33.9	31.2	71.2
Cat 420 Backhoe	2.2	8.1	8.5	1.5	1.40	0.92	84.5	311	327	57.6	53.0	53.8
Skid Steer Loader (Bobcat)	3.9	11.6	7.1	1.6	1.38	0.92	218	648	397	89.4	82.3	77.1
Cat 420 Backhoe	2.2	8.1	8.5	1.5	1.40	0.92	225	830	871	154	141	143
Cat 420 Backhoe	2.2	8.1	8.5	1.5	1.40	0.92	225	830	871	154	141	143
High Terrain Forklift	2.2	8.1	8.5	1.5	1.40	0.92	553	2,037	2,138	377	347	352
TOTAL EMISSIONS							**4,555**	**19,261**	**29,003**	**2,749**	**2,529**	**4,162**

	VOC	CO	NOx	PM-10	PM-2.5	SO_2
TOTAL EMISSIONS FROM ALL	**4,555**	**19,261**	**29,003**	**2,749**	**2,529**	**4,162**
TOTAL EMISSIONS FROM ALL	**2.28**	**9.6**	**14.5**	**1.37**	**1.26**	**2.08**

3.0 Calculation of Annual Actua

For Table 1: Annual Actual Emiss

Annual Actual PM-2.5 Emissions

Appendix B-25
2009 Emission Calculations for Off-road Diesel Vehicles
Fort Belvoir, Virginia

1.0 Data Required to Calculate Emissions from Off Road Diesel Vehicles

(b) Emission factors are obtained from EPA's Draft June 2000 Nonroad model and EPA's Exhaust Emission Factors for Nonroad Engine Modeling-Compression -Ignition, Report No. NR-009A, Revised June 1998.

2.0 Calculation of Criteria Pollutant Emission Rates

Table 1: Emissions Estimate Based on Engine Rating and Operating Time (All Diesel-fired Equipment)

Equipment Data										*Emission Parameters*		
Vehicle/Equipment Type	Equipment Category	Engine Type	Number of Units	Engine Rating (Per Unit) (hp)	Model Year	Operating Time (Per unit) (hr/yr)	Total Operating Time (hr/yr)	Source for Operating Time	Load Factor (Percent of Max. Power)	SCC	Emission Factor Group	Brake-Specific Fuel Consumption (lb/hp-hr)
Cat 345 Trackhoe	Construction	Reciprocating	2	321	1994	0	0	Developer	55%	A2270002066	Group 3	0.433
Cat 963 Loader	Construction	Reciprocating	2	160	1994	200	400	Developer	55%	A2270002066	Group 3	0.433
Cat D6 Dozer	Construction	Reciprocating	2	165	1994	200	400	Developer	64%	A2270002069	Group 4	0.360
Cat D7 Dozer	Construction	Reciprocating	1	215	1994	200	200	Developer	64%	A2270002069	Group 4	0.360
Cat 621 Scraper (Pan)	Construction	Reciprocating	2	330	1994	200	400	Developer	72%	A2270002018	Group 4	0.433
30 ton Off-road Volvo Truck	Construction	Reciprocating	2	300	1994	200	400	Developer	57%	A2270002051	Group 3	0.433
Cat 815 Roller	Construction	Reciprocating	1	220	1994	200	200	Developer	56%	A2270002015	Group 4	0.360
950G Rubber Tire loader	Construction	Reciprocating	1	180	1994	280	280	Developer	68%	A2270002060	Group 3	0.433
Cat RS-58 Roller	Construction	Reciprocating	1	100	1994	280	280	Developer	56%	A2270002015	Group 4	0.400
Cat 345 Trackhoe	Construction	Reciprocating	2	321	1994	280	560	Developer	55%	A2270002066	Group 3	0.433
Cat 433 Roller	Construction	Reciprocating	2	92	1994	280	560	Developer	56%	A2270002015	Group 4	0.400
950G Rubber Tire loader	Construction	Reciprocating	1	180	1994	140	140	Developer	68%	A2270002060	Group 3	0.433
Cat 815 Roller	Construction	Reciprocating	1	220	1994	140	140	Developer	56%	A2270002015	Group 4	0.360
BD 90HS Paver Roller	Construction	Reciprocating	1	100	1994	140	140	Developer	56%	A2270002015	Group 4	0.400
Blawknowx PF3200 Paver	Construction	Reciprocating	1	100	1994	140	140	Developer	53%	A2270002021	Group 4	0.400
12G Motor Grader	Construction	Reciprocating	1	140	1994	140	140	Developer	61%	A2270002048	Group 4	0.360
Cat 420 Backhoe	Construction	Reciprocating	1	88	1994	160	160	Developer	55%	A2270002066	Group 3	0.481
Skid Steer Loader (Bobcat)	Construction	Reciprocating	1	48	1994	420	420	Developer	55%	A2270002072	Group 3	0.481
Cat 420 Backhoe	Construction	Reciprocating	1	88	1994	420	420	Developer	55%	A2270002066	Group 3	0.481
Cat 420 Backhoe	Construction	Reciprocating	1	88	1994	420	420	Developer	55%	A2270002066	Group 3	0.481
High Terrain Forklift	Construction	Reciprocating	3	88	1994	1,440	4,320	Developer	30%	A2270003020	Group 3	0.481
TOTAL EMISSIONS												

TOTAL EMISSIONS FROM ALL DIESEL-FIRED VEHICLE/EQUIPMENT (lb/yr)
TOTAL EMISSIONS FROM ALL DIESEL-FIRED VEHICLE/EQUIPMENT(tpy)

3.0 Calculation of Annual Actual Criteria Pollutant Emissions

For Table 1: Annual Actual Emissions (lb/yr) = Engine Rating (hp) x Loading Factor (%) x Operating Time per Unit (hr/yr) x Number of Units x Emission Factor (g/hp-hr) x Conversion Factor (0.002205 lb/g)

Annual Actual PM-2.5 Emissions (lb/yr) = Annual Actual PM-10 Emissions (lb/yr) x Factor for Converting PM-10 to PM-2.5

Appendix B-25
2009 Emission Calculations for Off-road Diesel Vehicles
Fort Belvoir, Virginia

1.0 Data Required to Calculate I

(b) Emission factors are obtain

2.0 Calculation of Criteria Pollu

Table 1: Emissions Estimate B

	Emissions Factors						*Annual Actual Emissions*					
Vehicle/Equipment Type	**VOC Emission Factor (g/hp-hr)**	**CO Emission Factor (g/hp-hr)**	**NOx Emission Factor (g/hp-hr)**	**PM-10 Emission Factor (g/hp-hr)**	**SO_2 Emission Factor (g/hp-hr)**	**Factor for PM-10 to PM-2.5 5**	**VOC Emissions (lb/yr)**	**CO Emissions (lb/yr)**	**NOx Emissions (lb/yr)**	**PM-10 Emissions (lb/yr)**	**PM-2.5 Emissions (lb/yr)**	**SO_2 Emissions (lb/yr)**
Cat 345 Trackhoe	1.5	6.2	8.6	0.8	1.26	0.92	0	0	0	0	0	0
Cat 963 Loader	1.5	6.2	8.6	0.8	1.26	0.92	116	481	667	62.1	57.1	97.8
Cat D6 Dozer	0.6	3.4	8.3	0.5	1.05	0.92	55.9	317	773	46.6	42.8	97.8
Cat D7 Dozer	0.6	3.4	8.3	0.5	1.05	0.92	36.4	206	504	30.3	27.9	63.7
Cat 621 Scraper (Pan)	1.5	6.2	8.6	0.8	1.26	0.92	314	1,299	1,802	168	154	264
30 ton Off-road Volvo Truck	1.5	6.2	8.6	0.8	1.26	0.92	226	935	1,297	121	111	190
Cat 815 Roller	0.6	3.4	8.3	0.5	1.05	0.92	32.6	185	451	27.2	25.0	57.0
950G Rubber Tire loader	1.5	6.2	8.6	0.8	1.26	0.92	113	469	650	60.5	55.6	95.2
Cat RS-58 Roller	0.9	4.4	8.2	0.9	1.16	0.92	31.1	152	284	31.1	28.6	40.1
Cat 345 Trackhoe	1.5	6.2	8.6	0.8	1.26	0.92	327	1,352	1,875	174	160	275
Cat 433 Roller	0.9	4.4	8.2	0.90	1.16	0.92	57.3	280	522	57.3	52.7	73.8
950G Rubber Tire loader	1.5	6.2	8.6	0.8	1.26	0.92	56.7	234	325	30.2	27.8	47.6
Cat 815 Roller	0.6	3.4	8.3	0.5	1.05	0.92	22.8	129	316	19.0	17.5	39.9
BD 90HS Paver Roller	0.9	4.4	8.2	0.9	1.16	0.92	15.6	76.1	142	15.6	14.3	20.1
Blawknowx PF3200 Paver	0.9	4.4	8.2	0.9	1.16	0.92	14.7	72.0	134	14.7	13.5	19.0
12G Motor Grader	0.6	3.4	8.3	0.5	1.05	0.92	15.8	89.6	219	13.2	12.1	27.7
Cat 420 Backhoe	2.2	8.1	8.5	1.5	1.40	0.92	37.6	138	145	25.6	23.6	23.9
Skid Steer Loader (Bobcat)	3.9	11.6	7.1	1.6	1.38	0.92	95.4	284	174	39.1	36.0	33.7
Cat 420 Backhoe	2.2	8.1	8.5	1.5	1.40	0.92	98.6	363	381	67.2	61.9	62.8
Cat 420 Backhoe	2.2	8.1	8.5	1.5	1.40	0.92	98.6	363	381	67.2	61.9	62.8
High Terrain Forklift	2.2	8.1	8.5	1.5	1.40	0.92	553	2,037	2,138	377	347	352
TOTAL EMISSIONS							**1,766**	**7,425**	**11,040**	**1,070**	**984**	**1,592**

	VOC	CO	NOx	PM-10	PM-2.5	SO_2
TOTAL EMISSIONS FROM ALL	**1,766**	**7,425**	**11,040**	**1,070**	**984**	**1,592**
TOTAL EMISSIONS FROM ALL	**0.88**	**3.71**	**5.52**	**0.53**	**0.49**	**0.80**

3.0 Calculation of Annual Actua

For Table 1: Annual Actual Emiss

Annual Actual PM-2.5 Emissions

Appendix B-26
2010 Emission Calculations for Off-road Diesel Vehicles
Fort Belvoir, Virginia

1.0 Data Required to Calculate Emissions from Off Road Diesel Vehicles

(b) Emission factors are obtained from EPA's Draft June 2000 Nonroad model and EPA's Exhaust Emission Factors for Nonroad Engine Modeling-Compression -Ignition, Report No. NR-009A, Revised June 1998.

2.0 Calculation of Criteria Pollutant Emission Rates

Table 1: Emissions Estimate Based on Engine Rating and Operating Time (All Diesel-fired Equipment)

Equipment Data										*Emission Parameters*		
Vehicle/Equipment Type	Equipment Category	Engine Type	Number of Units	Engine Rating (Per Unit) (hp)	Model Year	Operating Time (Per unit) (hr/yr)	Total Operating Time (hr/yr)	Source for Operating Time	Load Factor (Percent of Max. Power)	SCC	Emission Factor Group	Brake-Specific Fuel Consumption (lb/hp-hr)
Cat 345 Trackhoe	Construction	Reciprocating	2	321	1994	0	0	Developer	55%	A2270002066	Group 3	0.433
Cat 963 Loader	Construction	Reciprocating	2	160	1994	0	0	Developer	55%	A2270002066	Group 3	0.433
Cat D6 Dozer	Construction	Reciprocating	2	165	1994	0	0	Developer	64%	A2270002069	Group 4	0.360
Cat D7 Dozer	Construction	Reciprocating	1	215	1994	0	0	Developer	64%	A2270002069	Group 4	0.360
Cat 621 Scraper (Pan)	Construction	Reciprocating	2	330	1994	0	0	Developer	72%	A2270002018	Group 4	0.433
30 ton Off-road Volvo Truck	Construction	Reciprocating	2	300	1994	0	0	Developer	57%	A2270002051	Group 3	0.433
Cat 815 Roller	Construction	Reciprocating	1	220	1994	0	0	Developer	56%	A2270002015	Group 4	0.360
950G Rubber Tire loader	Construction	Reciprocating	1	180	1994	80	80	Developer	68%	A2270002060	Group 3	0.433
Cat RS-58 Roller	Construction	Reciprocating	1	100	1994	80	80	Developer	56%	A2270002015	Group 4	0.400
Cat 345 Trackhoe	Construction	Reciprocating	2	321	1994	80	160	Developer	55%	A2270002066	Group 3	0.433
Cat 433 Roller	Construction	Reciprocating	2	92	1994	80	160	Developer	56%	A2270002015	Group 4	0.400
950G Rubber Tire loader	Construction	Reciprocating	1	180	1994	80	80	Developer	68%	A2270002060	Group 3	0.433
Cat 815 Roller	Construction	Reciprocating	1	220	1994	80	80	Developer	56%	A2270002015	Group 4	0.360
BD 90HS Paver Roller	Construction	Reciprocating	1	100	1994	80	80	Developer	56%	A2270002015	Group 4	0.400
Blawknowx PF3200 Paver	Construction	Reciprocating	1	100	1994	80	80	Developer	53%	A2270002021	Group 4	0.400
12G Motor Grader	Construction	Reciprocating	1	140	1994	80	80	Developer	61%	A2270002048	Group 4	0.360
Cat 420 Backhoe	Construction	Reciprocating	1	88	1994	80	80	Developer	55%	A2270002066	Group 3	0.481
Skid Steer Loader (Bobcat)	Construction	Reciprocating	1	48	1994	280	280	Developer	55%	A2270002072	Group 3	0.481
Cat 420 Backhoe	Construction	Reciprocating	1	88	1994	280	280	Developer	55%	A2270002066	Group 3	0.481
Cat 420 Backhoe	Construction	Reciprocating	1	88	1994	280	280	Developer	55%	A2270002066	Group 3	0.481
High Terrain Forklift	Construction	Reciprocating	3	88	1994	1,440	4,320	Developer	30%	A2270003020	Group 3	0.481
TOTAL EMISSIONS												

TOTAL EMISSIONS FROM ALL DIESEL-FIRED VEHICLE/EQUIPMENT (lb/yr)
TOTAL EMISSIONS FROM ALL DIESEL-FIRED VEHICLE/EQUIPMENT(tpy)

3.0 Calculation of Annual Actual Criteria Pollutant Emissions

For Table 1: Annual Actual Emissions (lb/yr) = Engine Rating (hp) x Loading Factor (%) x Operating Time per Unit (hr/yr) x Number of Units x Emission Factor (g/hp-hr) x Conversion Factor (0.002205 lb/g)

Annual Actual PM-2.5 Emissions (lb/yr) = Annual Actual PM-10 Emissions (lb/yr) x Factor for Converting PM-10 to PM-2.5

Appendix B-26
2010 Emission Calculations for Off-road Diesel Vehicles
Fort Belvoir, Virginia

1.0 Data Required to Calculate I

(b) Emission factors are obtain

2.0 Calculation of Criteria Pollu

Table 1: Emissions Estimate B

	Emissions Factors						*Annual Actual Emissions*					
Vehicle/Equipment Type	**VOC Emission Factor (g/hp-hr)**	**CO Emission Factor (g/hp-hr)**	**NOx Emission Factor (g/hp-hr)**	**PM-10 Emission Factor (g/hp-hr)**	**SO_2 Emission Factor (g/hp-hr)**	**Factor for PM-10 to PM-2.5 5**	**VOC Emissions (lb/yr)**	**CO Emissions (lb/yr)**	**NOx Emissions (lb/yr)**	**PM-10 Emissions (lb/yr)**	**PM-2.5 Emissions (lb/yr)**	**SO_2 Emissions (lb/yr)**
Cat 345 Trackhoe	1.5	6.2	8.6	0.8	1.26	0.92	0	0	0	0	0	0
Cat 963 Loader	1.5	6.2	8.6	0.8	1.26	0.92	0	0	0	0	0	0
Cat D6 Dozer	0.6	3.4	8.3	0.5	1.05	0.92	0	0	0	0	0	0
Cat D7 Dozer	0.6	3.4	8.3	0.5	1.05	0.92	0	0	0	0	0	0
Cat 621 Scraper (Pan)	1.5	6.2	8.6	0.8	1.26	0.92	0	0	0	0	0	0
30 ton Off-road Volvo Truck	1.5	6.2	8.6	0.8	1.26	0.92	0	0	0	0	0	0
Cat 815 Roller	0.6	3.4	8.3	0.5	1.05	0.92	0	0	0	0	0	0
950G Rubber Tire loader	1.5	6.2	8.6	0.8	1.26	0.92	32.4	134	186	17.3	15.9	27.2
Cat RS-58 Roller	0.9	4.4	8.2	0.9	1.16	0.92	8.89	43.5	81.0	8.89	8.18	11.5
Cat 345 Trackhoe	1.5	6.2	8.6	0.8	1.26	0.92	93.4	386	536	49.8	45.8	78.5
Cat 433 Roller	0.9	4.4	8.2	0.90	1.16	0.92	16.4	80.0	149	16.4	15.0	21.1
950G Rubber Tire loader	1.5	6.2	8.6	0.8	1.26	0.92	32.4	134	186	17.3	15.9	27.2
Cat 815 Roller	0.6	3.4	8.3	0.5	1.05	0.92	13.0	73.9	180	10.9	10.0	22.8
BD 90HS Paver Roller	0.9	4.4	8.2	0.9	1.16	0.92	8.89	43.5	81.0	8.89	8.18	11.5
Blawknowx PF3200 Paver	0.9	4.4	8.2	0.9	1.16	0.92	8.41	41.1	76.7	8.41	7.74	10.8
12G Motor Grader	0.6	3.4	8.3	0.5	1.05	0.92	9.04	51.2	125	7.53	6.93	15.8
Cat 420 Backhoe	2.2	8.1	8.5	1.5	1.40	0.92	18.8	69.2	72.6	12.8	11.8	12.0
Skid Steer Loader (Bobcat)	3.9	11.6	7.1	1.6	1.38	0.92	63.6	189	116	26.1	24.0	22.5
Cat 420 Backhoe	2.2	8.1	8.5	1.5	1.40	0.92	65.7	242	254	44.8	41.2	41.8
Cat 420 Backhoe	2.2	8.1	8.5	1.5	1.40	0.92	65.7	242	254	44.8	41.2	41.8
High Terrain Forklift	2.2	8.1	8.5	1.5	1.40	0.92	553	2,037	2,138	377.2	347	352
TOTAL EMISSIONS							**437**	**1,729**	**2,296**	**274**	**252**	**344**

	VOC	CO	NOx	PM-10	PM-2.5	SO_2
TOTAL EMISSIONS FROM ALL	**437**	**1,729**	**2,296**	**274**	**252**	**344**
TOTAL EMISSIONS FROM ALL	**0.22**	**0.86**	**1.15**	**0.14**	**0.13**	**0.17**

3.0 Calculation of Annual Actua

For Table 1: Annual Actual Emiss

Annual Actual PM-2.5 Emissions

Appendix B-27
2011 Emission Calculations for Off-road Diesel Vehicles
Fort Belvoir, Virginia

1.0 Data Required to Calculate Emissions from Off Road Diesel Vehicles

(b) Emission factors are obtained from EPA's Draft June 2000 Nonroad model and EPA's Exhaust Emission Factors for Nonroad Engine Modeling-Compression -Ignition, Report No. NR-009A, Revised June 1998.

2.0 Calculation of Criteria Pollutant Emission Rates

Table 1: Emissions Estimate Based on Engine Rating and Operating Time (All Diesel-fired Equipment)

Equipment Data										*Emission Parameters*		
Vehicle/Equipment Type	Equipment Category	Engine Type	Number of Units	Engine Rating (Per Unit) (hp)	Model Year	Operating Time (Per unit) (hr/yr)	Total Operating Time (hr/yr)	Source for Operating Time	Load Factor (Percent of Max. Power)	SCC	Emission Factor Group	Brake-Specific Fuel Consumption (lb/hp-hr)
Cat 345 Trackhoe	Construction	Reciprocating	2	321	1994	0	0	Developer	55%	A2270002066	Group 3	0.433
Cat 963 Loader	Construction	Reciprocating	2	160	1994	0	0	Developer	55%	A2270002066	Group 3	0.433
Cat D6 Dozer	Construction	Reciprocating	2	165	1994	0	0	Developer	64%	A2270002069	Group 4	0.360
Cat D7 Dozer	Construction	Reciprocating	1	215	1994	0	0	Developer	64%	A2270002069	Group 4	0.360
Cat 621 Scraper (Pan)	Construction	Reciprocating	2	330	1994	0	0	Developer	72%	A2270002018	Group 4	0.433
30 ton Off-road Volvo Truck	Construction	Reciprocating	2	300	1994	0	0	Developer	57%	A2270002051	Group 3	0.433
Cat 815 Roller	Construction	Reciprocating	1	220	1994	0	0	Developer	56%	A2270002015	Group 4	0.360
950G Rubber Tire loader	Construction	Reciprocating	1	180	1994	0	0	Developer	68%	A2270002060	Group 3	0.433
Cat RS-58 Roller	Construction	Reciprocating	1	100	1994	0	0	Developer	56%	A2270002015	Group 4	0.400
Cat 345 Trackhoe	Construction	Reciprocating	2	321	1994	0	0	Developer	55%	A2270002066	Group 3	0.433
Cat 433 Roller	Construction	Reciprocating	2	92	1994	0	0	Developer	56%	A2270002015	Group 4	0.400
950G Rubber Tire loader	Construction	Reciprocating	1	180	1994	0	0	Developer	68%	A2270002060	Group 3	0.433
Cat 815 Roller	Construction	Reciprocating	1	220	1994	0	0	Developer	56%	A2270002015	Group 4	0.360
BD 90HS Paver Roller	Construction	Reciprocating	1	100	1994	0	0	Developer	56%	A2270002015	Group 4	0.400
Blawknowx PF3200 Paver	Construction	Reciprocating	1	100	1994	0	0	Developer	53%	A2270002021	Group 4	0.400
12G Motor Grader	Construction	Reciprocating	1	140	1994	0	0	Developer	61%	A2270002048	Group 4	0.360
Cat 420 Backhoe	Construction	Reciprocating	1	88	1994	0	0	Developer	55%	A2270002066	Group 3	0.481
Skid Steer Loader (Bobcat)	Construction	Reciprocating	1	48	1994	160	160	Developer	55%	A2270002072	Group 3	0.481
Cat 420 Backhoe	Construction	Reciprocating	1	88	1994	160	160	Developer	55%	A2270002066	Group 3	0.481
Cat 420 Backhoe	Construction	Reciprocating	1	88	1994	160	160	Developer	55%	A2270002066	Group 3	0.481
High Terrain Forklift	Construction	Reciprocating	3	88	1994	960	2,880	Developer	30%	A2270003020	Group 3	0.481
TOTAL EMISSIONS												

TOTAL EMISSIONS FROM ALL DIESEL-FIRED VEHICLE/EQUIPMENT (lb/yr)
TOTAL EMISSIONS FROM ALL DIESEL-FIRED VEHICLE/EQUIPMENT(tpy)

3.0 Calculation of Annual Actual Criteria Pollutant Emissions

For Table 1: Annual Actual Emissions (lb/yr) = Engine Rating (hp) x Loading Factor (%) x Operating Time per Unit (hr/yr) x Number of Units x Emission Factor (g/hp-hr) x Conversion Factor (0.002205 lb/g)

Annual Actual PM-2.5 Emissions (lb/yr) = Annual Actual PM-10 Emissions (lb/yr) x Factor for Converting PM-10 to PM-2.5

Appendix B-27
2011 Emission Calculations for Off-road Diesel Vehicles
Fort Belvoir, Virginia

1.0 Data Required to Calculate I

(b) Emission factors are obtain

2.0 Calculation of Criteria Pollu

Table 1: Emissions Estimate B

	Emissions Factors						*Annual Actual Emissions*					
Vehicle/Equipment Type	VOC Emission Factor (g/hp-hr)	CO Emission Factor (g/hp-hr)	NOx Emission Factor (g/hp-hr)	PM-10 Emission Factor (g/hp-hr)	SO_2 Emission Factor (g/hp-hr)	Factor for PM-10 to PM-2.5 5	VOC Emissions (lb/yr)	CO Emissions (lb/yr)	NOx Emissions (lb/yr)	PM-10 Emissions (lb/yr)	PM-2.5 Emissions (lb/yr)	SO_2 Emissions (lb/yr)
Cat 345 Trackhoe	1.5	6.2	8.6	0.8	1.26	0.92	0	0	0	0	0	0
Cat 963 Loader	1.5	6.2	8.6	0.8	1.26	0.92	0	0	0	0	0	0
Cat D6 Dozer	0.6	3.4	8.3	0.5	1.05	0.92	0	0	0	0	0	0
Cat D7 Dozer	0.6	3.4	8.3	0.5	1.05	0.92	0	0	0	0	0	0
Cat 621 Scraper (Pan)	1.5	6.2	8.6	0.8	1.26	0.92	0	0	0	0	0	0
30 ton Off-road Volvo Truck	1.5	6.2	8.6	0.8	1.26	0.92	0	0	0	0	0	0
Cat 815 Roller	0.6	3.4	8.3	0.5	1.05	0.92	0	0	0	0	0	0
950G Rubber Tire loader	1.5	6.2	8.6	0.8	1.26	0.92	0	0	0	0	0	0
Cat RS-58 Roller	0.9	4.4	8.2	0.9	1.16	0.92	0	0	0	0	0	0
Cat 345 Trackhoe	1.5	6.2	8.6	0.8	1.26	0.92	0	0	0	0	0	0
Cat 433 Roller	0.9	4.4	8.2	0.90	1.16	0.92	0	0	0	0	0	0
950G Rubber Tire loader	1.5	6.2	8.6	0.8	1.26	0.92	0	0	0	0	0	0
Cat 815 Roller	0.6	3.4	8.3	0.5	1.05	0.92	0	0	0	0	0	0
BD 90HS Paver Roller	0.9	4.4	8.2	0.9	1.16	0.92	0	0	0	0	0	0
Blawknowx PF3200 Paver	0.9	4.4	8.2	0.9	1.16	0.92	0	0	0	0	0	0
12G Motor Grader	0.6	3.4	8.3	0.5	1.05	0.92	0	0	0	0	0	0
Cat 420 Backhoe	2.2	8.1	8.5	1.5	1.40	0.92	0	0	0	0	0	0
Skid Steer Loader (Bobcat)	3.9	11.6	7.1	1.6	1.38	0.92	36.3	108	66.1	14.9	13.7	12.9
Cat 420 Backhoe	2.2	8.1	8.5	1.5	1.40	0.92	37.6	138	145	25.6	23.6	23.9
Cat 420 Backhoe	2.2	8.1	8.5	1.5	1.40	0.92	37.6	138	145	25.6	23.6	23.9
High Terrain Forklift	2.2	8.1	8.5	1.5	1.40	0.92	369	1,358	1,425	251	231	235
TOTAL EMISSIONS							**111**	**385**	**356**	**66.1**	**60.8**	**60.7**

	VOC	CO	NOx	PM-10	PM-2.5	SO_2
TOTAL EMISSIONS FROM ALL	**111**	**385**	**356**	**66.1**	**60.8**	**60.7**
TOTAL EMISSIONS FROM ALL	**0.056**	**0.19**	**0.18**	**0.033**	**0.030**	**0.030**

3.0 Calculation of Annual Actua

For Table 1: Annual Actual Emiss

Annual Actual PM-2.5 Emissions

Table 4-4
Summary of Proposed Action Actual Emissions
Fort Belvoir, Virginia

Activities	Annual Actual Emissions (tpy) VOC	CO	NOx	SO2	PM-10
Year 2004					
Stationary Sources					
Heating Units (Net Change)	7.51E-04	0.005	0.013	8.19E-05	0.001
Stone Crusher	--	--	--	--	0
Woodworking Facilities	--	--	--	--	0
Concrete Batch Plant	--	--	--	--	0.031
Subtotal	**7.51E-04**	**0.005**	**0.013**	**8.19E-05**	**0.032**
Mobile Sources					
On-Road Vehicles (Personal)	0.19	2.95	0.33	0.024	0.25
Off-Road Vehicles (Construction)	1.30	5.58	8.57	1.22	0.79
Subtotal	**1.50**	**8.53**	**8.90**	**1.25**	**1.04**
2004 Total	***1.50***	***8.54***	***8.91***	***1.25***	***1.08***
Year 2005					
Stationary Sources					
Heating Units (Net Change)	#REF!	#REF!	#REF!	#REF!	#REF!
Stone Crusher	--	--	--	--	0.007
Woodworking Facilities	--	--	--	--	0.001
Concrete Batch Plant	--	--	--	--	0.031
Subtotal	**#REF!**	**#REF!**	**#REF!**	**#REF!**	**#REF!**
Mobile Sources					
On-Road Vehicles (Personal)	0.19	2.95	0.33	0.024	0.25
Off-Road Vehicles (Construction)	1.93	7.98	11.6	1.68	1.18
Subtotal	**2.12**	**10.9**	**11.9**	**1.71**	**1.43**
2005 Total	***#REF!***	***#REF!***	***#REF!***	***#REF!***	***#REF!***
Year 2006					
Stationary Sources					
Heating Units (Net Change)	0.27	1.99	4.68	0.030	0.38
Stone Crusher	--	--	--	--	0.003
Woodworking Facilities	--	--	--	--	0.001
Concrete Batch Plant	--	--	--	--	0.031
Subtotal	**0.27**	**1.99**	**4.68**	**0.030**	**0.41**
Mobile Sources					
On-Road Vehicles (Personal)	0.35	5.37	0.59	0.044	0.46
Off-Road Vehicles (Construction)	2.63	11.1	16.5	2.37	1.59
Subtotal	**2.98**	**16.4**	**17.1**	**2.42**	**2.05**
2006 Total	***3.26***	***18.4***	***21.8***	***2.45***	***2.46***
Year 2007					
Stationary Sources					
Heating Units (Net Change)	0.26	1.89	4.43	0.028	0.358
Stone Crusher	--	--	--	--	0.003
Woodworking Facilities	--	--	--	--	0.001
Concrete Batch Plant	--	--	--	--	0.031
Subtotal	***0.26***	***1.89***	***4.43***	***0.028***	***0.39***
Mobile Sources					
On-Road Vehicles (Personal)	0.35	5.37	0.59	0.044	0.46

Table 4-4
Summary of Proposed Action Actual Emissions
Fort Belvoir, Virginia

Activities	Annual Actual Emissions (tpy) VOC	CO	NOx	SO2	PM-10
Year 2008					
Stationary Sources					
Heating Units (Net Change)	0.19	1.36	3.21	0.020	0.26
Stone Crusher	--	--	--	-	0.002
Woodworking Facilities	--	--	--	-	0.001
Concrete Batch Plant	--	--	--	--	0.031
Subtotal	**0.19**	**1.36**	**3.21**	**0.020**	**0.29**
Mobile Sources					
On-Road Vehicles (Personal)	0.35	5.37	0.59	0.044	0.46
Off-Road Vehicles (Construction)	2.28	9.63	14.5	2.08	1.37
Subtotal	**2.63**	**15.0**	**15.1**	**2.13**	**1.84**
2008 Total	***2.81***	***16.4***	***18.3***	***2.15***	***2.13***
Year 2009					
Stationary Sources					
Heating Units (Net Change)	0.063	0.46	1.08	0.007	0.088
Stone Crusher	--	--	--	--	0.001
Woodworking Facilities	--	--	--	--	0.001
Concrete Batch Plant	--	--	--	--	0.018
Subtotal	**0.063**	**0.46**	**1.08**	**0.007**	**0.11**
Mobile Sources					
On-Road Vehicles (Personal)	0.19	2.95	0.33	0.024	0.25
Off-Road Vehicles (Construction)	0.88	3.71	5.52	0.80	0.53
Subtotal	**1.08**	**6.67**	**5.85**	**0.82**	**0.79**
2009 Total	***1.14***	***7.13***	***6.93***	***0.83***	***0.90***
Year 2010					
Stationary Sources					
Heating Units (Net Change)	0.009	-0.020	-0.32	-1.38	-0.050
Stone Crusher	--	--	--	--	0.001
Woodworking Facilities	--	--	--	--	0.001
Concrete Batch Plant	--	--	--	--	0.009
Subtotal	**0.009**	**-0.020**	**-0.32**	**-1.38**	**-0.04**
Mobile Sources					
On-Road Vehicles (Personal)	0.12	1.79	0.20	0.015	0.15
Off-Road Vehicles (Construction)	0.22	0.86	1.15	0.17	0.14
Subtotal	**0.33**	**2.65**	**1.35**	**0.19**	**0.29**
2010 Total	***0.34***	***2.63***	***1.03***	***-1.20***	***0.25***
Year 2011					
Stationary Sources					
Heating Units (Net Change)	0.039	0.28	0.67	0.004	0.054
Stone Crusher	--	--	--	--	0.001
Woodworking Facilities	--	--	--	--	0
Concrete Batch Plant	--	--	--	--	0
Subtotal	**0.039**	**0.28**	**0.67**	**0.004**	**0.055**
Mobile Sources					
On-Road Vehicles (Personal)	0.12	1.79	0.20	0.015	0.15
Off-Road Vehicles (Construction)	0.056	0.19	0.18	0.030	0.033
Subtotal	**0.17**	**1.98**	**0.38**	**0.045**	**0.19**
2011 Total	***0.21***	***2.27***	***1.04***	***0.049***	***0.24***

Table 4-6

General Conformity Analysis
Fort Belvoir, Virginia

	Annual Actual Emissions (tpy)	
Activities	**VOC**	**NOx**
2004 Total	*1.50*	*8.91*
2005 Total	*2.29*	*14.4*
2006 Total	*3.26*	*21.8*
2007 Total	3.37	22.4
2008 Total	*2.81*	*18.3*
2009 Total	*1.14*	*6.93*
2010 Total	*0.34*	*1.03*
2011 Total	*0.21*	*1.04*
***De minimis* level**	**25.0**	**25.0**

Appendix C
Soils on Fort Belvoir

TABLE C-1

Types and Selected Physical Characteristics of Soil found at Fort Belvoir

Map Unit Name	Slope	Taxonomy	Drainage Class[1]	Flooding	Permeability[2]	Erosion Factor[3]
Appling gritty loam	2-7%	Typic Hapludults	WD	No	MR surface, M subsoil and substratum	4
Appling gritty loam	7-15%	Typic Hapludults	WD	No	MR surface, M subsoil and substratum	4
Appling gritty loam	15-25%	Typic Hapludults	WD	No	MR surface, M subsoil and substratum	4
Beltsville silt loam	0-7%	Typic Fragiudults	MWD	No	S-VS above and below fragipan, VS within fragipan, M-MR in substratum	3
Beltsville loam	2-7%	Typic Fragiudults	MWD	No	S-VS above and below fragipan, VS within fragipan, M-MR in substratum	3
Beltsville silt loam	7-15%	Typic Fragiudults	MWD	No	S-VS above and below fragipan, VS within fragipan, M-MR in substratum	3
Bertie silt loam	0-2%	Aquic Hapludults	MWD	No	M	5
Chewacla silt loam	0-2%	Fluvaquentic Dystrochrepts	SPD	Frequent (Nov-Apr)	M surface and subsoil	5
Dragston fine sandy loam	0-2%	Aeric Ochraquults	SPD	No	MR	4
Dumfries sandy loam	2-7%	Typic Hapludults	WD	No	MR, MR subsoil, R substratum	5
Dumfries sandy loam	7-15%	Typic Hapludults	WD	No	MR, MR subsoil, R substratum	5
Dumfries sandy loam	15-25%	Typic Hapludults	WD	No	MR, MR subsoil, R substratum	5
Dumfries sandy loam	25-50%	Typic Hapludults	WD	No	MR, MR subsoil, R	5

TABLE C-1

Types and Selected Physical Characteristics of Soil found at Fort Belvoir

Map Unit Name	Slope	Taxonomy	Drainage Class[1]	Flooding	Permeability[2]	Erosion Factor[3]
					substratum	
Fallsington fine sandy loam	0-2%	Typic Ochraquults	PD	No	M	4
Galestown loamy fine sand	0-2%	Psammentic Hapludults	SED	No	R, MR subsoil, R substratum	5
Glenelg silt loam	2-7%	Typic Hapludults	WD	No	M	3
Glenelg silt loam	7-15%	Typic Hapludults	WD	No	M	3
Keyport silt loam	--	Aquic Hapludults	MWD	No	MS surface, S subsoil, M substratum	3-2
Lenoir silt loam	0-2%	Aquic Paleaquults	SPD	No	VS	5
Louisburg coarse sandy loam	7-25%	Ruptic-Ultic Dystrochrepts	SED-WD	No	MR surface & substratum, M-MR subsoil	2
Louisburg coarse sandy loam	25-50%	Ruptic-Ultic Dystrochrepts	SED-WD	No	MR surface and substratum, M-MR Subsoil	2
Lunt fine sandy loam	2-7%	Typic Hapludalfs	WD-MWD	No	M-MR surface, M subsoil, MR-VR substratum	4
Lunt fine sandy loam	7-15%	Typic Hapludalfs	WD-MWD	No	M-MR surface, M subsoil, MR-VR substratum	4
Lunt fine sandy loam	15-25%	Typic Hapludalfs	WD-MWD	No	M-MR surface, M subsoil, MR-VR substratum	4
Matapeake silt loam	2-7%	Typic Hapludults	WD	No	M surface and subsoil	4
Matapeake silt loam	7-15%	Typic Hapludults	WD	No	M surface and subsoil	4
Mattapex silt loam	2-6%	Aquic Hapludults	WD	No	M	4
Mattapex silt loam	6-10%	Aquic Hapludults	MWD	No	M	4
Quantico fine sandy loam	7-15%	Typic Hapludults	WD	No	MR surface, M subsoil, M-MR substratum	4

TABLE C-1

Types and Selected Physical Characteristics of Soil found at Fort Belvoir

Map Unit Name	Slope	Taxonomy	Drainage Class[1]	Flooding	Permeability[2]	Erosion Factor[3]
Quantico fine sandy loam	15-25%	Typic Hapludults	WD	No	MR surface, M subsoil, M-MR substratum	4
Sassafras fine sandy loam	2-6%	Typic Hapludults	WD	No	M, R substratum	4
Sassafras fine sandy loam	6-10%	Typic Hapludults	WD	No	M, R substratum	4
Wehadkee silt loam	0-2%	Typic Fluvaquents	PD	Frequent (Nov-Jun)	M	5
Woodstown fine sandy loam	0-2%	Aquic Hapludults	MWD	No	M	4
Woodstown fine sandy loam	2-6%	Aquic Hapludults	MWD	No	M	4
Woodstown fine sandy loam	6-10%	Aquic Hapludults	MWD	No	M	4
Mixed alluvial	0-2%	Entisols	PD	Frequent (Jan-Dec)	M	5
Tidal marsh		Histosols	VPD	Frequent (Jan-Dec)	M	--
Cut and fill		--	--	No	--	--
Urban land	0-10%	--	--	No	>70% impervious	--

TABLE C-1

Types and Selected Physical Characteristics of Soil found at Fort Belvoir

Map Unit Name	Slope	Taxonomy	Drainage Class[1]	Flooding	Permeability[2]	Erosion Factor[3]

[1]Drainage Class Key:

MWD: Moderately well drained
SPD: Somewhat poorly drained
PD: Poorly drained
VPD: Very poorly drained
SED: Somewhat excessively drained
WD: Well drained

[2]Permeability Key (depth per hour):

VS: Very slow	(less than 0.06“)	MR: Moderately rapid	(2.0 to 6.0”)
S: Slow	(0.06 to 0.2”)	R: Rapid	(6.0 to 20”)
MS: Moderately slow	(0.2 to 0.6”)	VR: Very rapid	(more than 20”)
M: Moderate	(0.6 to 2.0”)		

[3]Erosion factor given is the “T” factor, representing an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting soil fertility over a sustained period. Rate is in tons per acre per year.

Appendix D
Vegetative Communities on Fort Belvoir

PLANT COMMUNITIES MAPPED ON FORT BELVOIR

Oak Mesic - Ericad (Heath Family) Forests

Oak / ericad forests are upland forests of gravelly ridges and dry slopes, generally located at the tops of hills and bluffs and along steep, well-drained slopes. The overstory is dominated by chestnut oak (*Quercus prinus*), with a mixture of northern red oak (*Quercus rubra*), white oak (*Quercus alba*), and scarlet oak (*Quercus coccinea*). At Fort Belvoir, vegetation in the understory varies between two topographically different types. Arid plateaus are generally composed of chestnut oak and white oak with huckleberry (*Gaylussacia baccata*) and tall deer berry (Vaccinium stamineum) in the understory. Cooler, northerly-facing steep slopes are dominated by chestnut oak, and the understory generally consists of mountain laurel (*Kalmia latifolia*) (Paciulli, Simmons and Associates, Ltd., 1998).

Beech Mesic - Mixed Oak Forests

At Fort Belvoir, beech mixed oak forests are generally located on the more gradual slopes, topographically below oak / ericad forests. Mixed oak species of white oak and northern red oak are dominant trees with American beech (*Fagus grandifolia*) dominant as shrubs in the understory. Other common shrubs in the understory consist of flowering dogwood (*Cornus florida*), red maple (*Acer rubrum*), and cherryleaf viburnum (*Viburnum prunifolium*). Occasional areas of mature American beech are found in lower, moister elevations or within ravines (Paciulli, Simmons and Associates, Ltd., 1998).

Tulip Poplar Mesic - Mixed Hardwood Forest

Tulip poplar mixed hardwood forests are upland forests of moist fertile ravine slopes and ravine bottoms. At Fort Belvoir, they are found in habitats similar to beech mixed oak forest, but are more common on more gradual slopes and ravine bottoms. Tulip poplar (*Liriodendron tulipifera*) trees are dominant within this vegetation community type, but American beech, white oak, and northern red oak are also mixed. Understory species are similar to that of beech mixed oak forests and consist of flowering dogwood, American beech, and red maple shrubs (Paciulli, Simmons and Associates, Ltd., 1998). A tulip popular mixed hardwood forest community just west of the mouth of Accotink Creek, within the Accotink Bay Wildlife Refuge, has been identified as a significant community of its type due

to its age and extent. This community type is common in Virginia; however, mature examples are rare (Hobson, 1996).

Seep Forests

Seep forests are often open-canopy forests of groundwater-saturated flats and slopes, generally surrounded by mixed hardwood forests. They occur along slopes where groundwater flows to the surface. Characteristic species are red maple, black gum (*Nyssa sylvatica*), sweetbay magnolia (*Magnolia virginiana*), skunk cabbage (*Symplocarpus foetidus*), sensitive fern (*Onoclea sensibilis*), and royal fern (*Osmunda regalis*). Key indicators are large mats of skunk cabbage and other herbaceous wetland vegetation. Although not a dominant forest type, seep forests are of special interest at Fort Belvoir, because they provide unique wetland habitats within the dominant upland forests (Paciulli, Simmons and Associates, Ltd., 1998). Three acid seep swamps on Fort Belvoir have been identified as significant vegetation communities. One of these is adjacent to the fresh tidal marsh at the mouth of Accotink Creek, another lies at the foot of upland slopes in Training Areas T-9 and T-7, and the third is located on HEC in the Dogue Creek watershed. These seeps provide habitat on Fort Belvoir for the state rare sphagnum sprite (*Nehafennia gracilis*) and a state -rare sedge (*Carex vestita*). They also provide habitat for several watchlist species (species ranked by DCR-NHP as S3 - "rare to uncommon," or SU - "status uncertain") including the gray petaltail (*Tachopteryx thoreyi*), aurora damsel (*Chromagrion conditum*), and eastern red damsel (*Amphiagrion saucium*). The watchlist dragonfly species, *Gomphaeschna furcillata*, has also been recorded in this habitat on Fort Belvoir (Hobson, 1996).

Mixed Pine Hardwood Forests

Mixed pine hardwood forests consist of transitional forests between early successional pine and climax hardwood types. Vegetation is a variable mix of pines, oaks, and other hardwoods. At Fort Belvoir, mixed pine hardwood forests were identified where hardwoods and pine trees appeared to be evenly distributed or where neither hardwoods nor pines appeared to be more than 70% dominant. Virginia pine is the dominant pine in mixed pine hardwood forests, although some stands mixed with loblolly pine exist. Dominant hardwoods in mixed pine hardwood forests are variable, but can be generalized

based on topography and their position bordering mapped hardwoods. For example, mixed pine hardwood forests mapped at the tops of dry ridges and bordered by oak/ericad forest are likely to have chestnut oak or scarlet oak as the dominant hardwood in the mix. Lowland areas tend to have tulip poplar and red maple mixed with Virginia pine. Upland areas tend to be mixed with white oak and chestnut oak (Paciulli, Simmons and Associates, Ltd., 1998).

Virginia Pine Forests

Virginia pine forests consist of early successional forest of old fields or other land clearings dominated by Virginia pine (greater than 70% dominance). Virginia pines are most abundant and occur naturally compared to forests of loblolly pine and white pine, which most likely have been introduced by plantings in former clearings (Paciulli, Simmons and Associates, Ltd., 1998).

Loblolly Pine Forest

Small portions of the installation have been planted in loblolly pine. The loblolly pine forests at Fort Belvoir are usually planted and often appear in rows. Native stands are not prevalent at Fort Belvoir (Paciulli, Simmons and Associates, Ltd., 1998).

White Pine Forest

One stand of planted white pine large enough for mapping occurs at the Elhers Road entrance to Davison Army Airfield. White pine is also used throughout Fort Belvoir for landscaping; however, these areas were not included because they are located within improved grounds (Paciulli, Simmons and Associates, Ltd., 1998).

Moderately Well-Drained Floodplain Hardwood Forests

Moderately well-drained floodplain hardwood forests are dominant within the major floodplains. They are palustrine forests of moderately well-drained to somewhat poorly-drained floodplain bottomland. These hardwood forests are generally located above streambanks in non-hydric soils that are mixed with upland and wetland vegetation. They are flooded regularly, but the well-drained soils do not retain hydrology long enough to

support wetland vegetation. At Fort Belvoir, moderately well-drained floodplain hardwood forests are dominated by tulip poplar mixed with red maple and sweet *gum (Liquidambar styraciflua*) trees. The understory consists of ironwood (*Carpinus caroliniana*), red maple, and spicebush (*Lindera benzoin*) shrubs. In both the moderately well-drained floodplain hardwood forests and tulip poplar mixed hardwood forests, the tulip poplar is the dominant indicator species. However, the composition of other characteristic species is significantly different. Characteristic species of moderately well-drained floodplain hardwood forests are adapted to moister soils within the floodplain (Paciulli, Simmons and Associates, Ltd., 1998).

Poorly Drained Floodplain Hardwood Forest

The poorly drained floodplain hardwood forest type is a palustrine forest occurring on somewhat poorly- drained to very poorly-drained floodplain bottomlands and sloughs. Its composition is variable, and it is generally located on hydric soils (soils that are inundated or saturated for a significant amount of time so that anaerobic conditions are created) dominated by hydrophytic vegetation (plants typically found in wetland habitats). They are most extensive along Pohick Creek and Accotink Creek floodplains and consist of a variable mix of pin oak (*Quercus palustris*), willow oak (*Quercus phellos*), green ash (*Fraxinus pennsylvanica*), sycamore (*Platanus occidentalis*), red maple, river birch (*Betula nigra*) and sweet gum. The understory contains highbush blueberry (*Vaccinium corymbosum*) (Paciulli, Simmons and Associates, Ltd., 1998).

Poorly drained hardwood forests differ from moderately well-drained hardwood forests in that they are located on wetter soils and are dominated by hydrophytic vegetation. Moderately well-drained floodplain hardwood forests are located within drier soils and are mixed with hydrophytic and non-hydrophytic vegetation. Poorly drained floodplain hardwood forests are usually jurisdictional wetlands under Section 404 of the Clean Water Act.

Non-Tidal Marsh/Beaver Pond Community

Non-tidal marsh / beaver pond areas are successional herbaceous to scrubby wetlands of variable composition. They consist of emergent wetlands that are above the tidal limits of

Accotink Creek and Pohick Creek, and emergent wetlands within Jackson Miles Abbott Wetland Refuge along Dogue Creek. Large areas of emergent wetlands border the braided channels within Pohick Creek's floodplain and above the tidal influence. Many of these areas are created or influenced by beaver activity that has caused flooding and created open marshes in areas previously dominated by hardwood forests. Beavers have created a large marsh along Poe Road. Vegetation composition is variable, consisting of emergents including arrow arum (*Peltandra virginica*), rice cutgrass (*Leersia oryzoides*), sedges (Carex sp.), rushes (Juncus sp.), smartweeds (Polygonum sp.), and swamp rose mallow (*Hibiscus moscheutos*). Common shrubs are buttonbush (*Cephalanthus occidentalis*), swamp rose (*Rosa palustris*), and swamp dogwood (*Cornus amomum*) (Paciulli, Simmons and Associates, Ltd. 1998). The beaver pond complexes at Fort Belvoir support two state-rare damselfly species: the sphagnum sprite and the furtive forktail (*Ischnura prognata*). The state rare least bittern (*Ixobrychus exilis*) has been known to use marshes in the Dogue Creek wetlands (Hobson, 1996).

Tidal Marsh Community

Tidal marshes dominate shallow tidal areas of Accotink and Pohick Creeks, and also occur at the mouths of several streams that flow from Fort Belvoir into surrounding tidal waters. Tidal marsh consists of a variable mix of emergent wetland vegetation such as arrow arum, yellow pond lily (*Nuphar luteum*), pickerelweed (*Pontedaria cordata*), wild *rice (Zizania aquatica*), cattail (*Typha latifolia*), and river bulrush (*Scirpus fluviatilis*) (Paciulli, Simmons and Associates, Ltd., 1998).

The fresh tidal marsh at the mouth of Accotink Creek is an area of semipermanently flooded herbaceous vegetation, which has been identified as a significant community. It represents a community type that is fairly uncommon in Virginia. This community is in good to excellent condition with little evidence of disturbance and is one of the better examples of its type in Virginia. Several rare plant species, including vetchling (*Lathyrus palustris*), water-plantain spearwort (*Ranunculus ambigens*), and river bulrush (*Scirpus fluviatilis*) occur within this community at the head of Accotink Bay. The watchlist plant species large bur-reed (*Sparganium eurycarpum*) and creeping spikerush (*Eleocharis smallii*) also occur within this community (Hobson, 1996).

Freshwater Tidal Swamp Forest Community

Freshwater tidal swamp forests are tidally influenced palustrine forests. At Fort Belvoir, the dominant trees are green ash and red maple. The understory composition is variable, and influenced by the extent of tidal flooding and openness of the canopy. Typical shrubs in less inundated areas include highbush blueberry, arrowwood viburnum, and silky dogwood (Cornus amomum) in areas less inundated. Areas that have an open canopy and are semi-permanently to permanently flooded have an understory that includes typical broadleaf emergents such as arrow arum, yellow pond lily and pickerelweed that occupy adjacent tidal marshes (Paciulii, Simmons and Associates, Ltd., 1998). Two significant areas of tidal swamp forest occur as peninsulas that extend into Gunston Cove. Tidal forests are also located along the upper tidal limits of Accotink Bay.

Tidal Scrub/Shrub Wetland Community

Tidal scrub / shrub wetlands at Fort Belvoir are the least dominant tidal vegetation community and are generally located along the edges of tidal swamp forests near the transition to tidal marsh. They are tidally influenced palustrine scrub / shrub wetlands dominated by woody plants less than three inches in diameter at breast height, but greater than 3.2 feet in height. Tidal scrub / shrub vegetation at Fort Belvoir consists of black willow (*Salix nigra*), red maple, common alder (*Alnus serruluta*), and green ash (Paciulli, Simmons and Associates, Ltd., 1998).

Old Field Grasslands

In the Mid-Atlantic region, old field grasslands generally are abandoned fields and clearings that are still in early successional stages. At Fort Belvoir, they generally consist of unimproved open fields or areas that are infrequently mowed. Old field grasslands occur in areas previously cleared for landfills, farming, and training. Approximately 190 acres of grasslands and potential grasslands have been identified at Fort Belvoir. They range in size from less than one-half acre to more than 20 acres (PaciuIli, Simmons and Associates, Ltd., 1996). Old field grasslands do not include grounds such as golf course roughs since they tend to be landscaped and mowed occasionally. Dominant vegetation consists of a variable mix of grasses and wildflowers (forbs). Characteristic species are *broomsedge (Andropogon*

virginicus), tall fescue (*Festuca elatior*), and bushclover (*Lespedeza cunneata*). These areas are valuable for providing habitat for song birds, ground nesting birds, and small mammals, which provide food sources for wildlife such as fox and birds of-prey (Paciulli, Simmons and Associates, Ltd., 1998).

Urban Land

All developed areas-at Fort Belvoir are identified as urban land. Urban land consists of improved and semi-improved grounds. This includes open lands, natural tree stands and woodland borders, buildings and paved areas, turf and landscaped areas. Open areas such as the airfield and golf courses are considered urban land. The vegetation is characterized by a wide variety of native trees, planted landscape trees and shrubs, tall fescue grass, and Kentucky bluegrass (*Festuca arundinacea*) (Paciulli, Simmons and Associates, Ltd., 1998). Vegetation management of developed lands is presented in the following chapter 10.0 Developed Areas.

Appendix E
Animal Species on Fort Belvoir

TABLE E-1
Wildlife Expected or Known to Occur at Fort Belvoir

Common Name	Scientific Name
Mammals	
Northern short-tailed shrew	*Blarina brevicauda*
Smokey shrew	*Sorex fumeus*
Pygmy shrew	*Sorex hoyi*
Southeastern shrew	*Sorex longirostris*
Star-nosed mole	*Condylura cristata*
Eastern mole	*Scalopus aquaticus*
White-footed mouse	*Peromyscus leucopus*
Deer mouse	*Peromyscus maniculatus*
House mouse	*Mus musculus*
Jumping mouse	*Zapus hudsonius*
Meadow vole	*Microtus pennsylvanicus*
Woodland vole	*Microtus pinetorum*
Least shrew	*Cryptotis parva*
Marsh rice rat	*Oryzomys palustris*
Big brown bat	*Eptesicus fuscus*
Little brown bat	*Myotis lucifugus*
Hoary bat	*Lasiurus cinereus*
Indiana bat	*Myotis sodalis*
Small-footed bat	*Myotis leibii*
Evening bat	*Nycticeius humeralis*
Red bat	*Lasiurus borealis*
Silver-haired bat	*Lasionycteris noctivagans*
Eastern pipistrelle	*Pipistrellus subflavus*
Keen's Myotis	*Myotis keenii*
Beaver	*Castor canadensis*
Muskrat	*Ondatra zibethicus*
Long tailed weasel	*Mustela frenata*
Opossum	*Didelphis virginiana*
Woodchuck	*Marmota monax*
Common striped skunk	*Mephitis mephitis*
Raccoon	*Procyon lotor*

TABLE E-1
Wildlife Expected or Known to Occur at Fort Belvoir

Common Name	Scientific Name
Eastern cottontail	*Sylvilagus floridanus*
Mink	*Mustela vison*
Eastern gray squirrel	*Sciurus carolinensis*
Flying squirrel	*Glaucomys volans*
Eastern chipmunk	*Tamias striatus*
River otter	*Lutra canadensis*
Norway rat	*Rattus norvegicus*
Whitetail deer	*Odocoileus virginianus*
Bobcat	*Lynx rufus*
Gray fox	*Urocyon cinereoargenteus*
Red fox	*Vulpes vulpes*
Coyote	*Canis latrans*
Birds	
Brown creeper	*Certhia familiaris*
Long-billed marsh wren	*Cistothorus palustris*
Sedge wren	*Cistothorus platensis*
Carolina wren	*Thryothorus ludovicianus*
House wren	*Troglodytes aedon*
Winter wren	*Troglodytes troglodytes*
Blue-gray gnatcatcher	*Polioptila caerulea*
Golden-crowned kinglet	*Regulus satrapa*
Ruby-crowned kinglet	*Regulus calendula*
Veery	*Catharus fuscescens*
Hermit thrush	*Catharus guttatus*
Gray-cheeked thrush	*Catharus minimus*
Swainson's thrush	*Catharus ustulatus*
Wood thrush	*Hylocichla mustelina*
Eastern bluebird	*Sialia sialis*
American robin	*Turdus migratorius*
Gray catbird	*Dumetella carolinensis*
Northern mockingbird	*Mimus polyglottos*
Brown thrasher	*Toxostoma rufum*

TABLE E-1
Wildlife Expected or Known to Occur at Fort Belvoir

Common Name	Scientific Name
Cedar waxwing	*Bombycilla cedrorum*
Loggerhead shrike	*Lanius ludovicianus*
European Starling	*Sturnus vulgaris*
Red-eyed vireo	*Vireo olivaceus*
Yellow-throated vireo	*Vireo flavifrons*
Warbling vireo	*Vireo gilvus*
White-eyed vireo	*Vireo griseus*
Philadelphia vireo	*Vireo philadelphicus*
Solitary vireo	*Vireo solitarius*
Bay-breasted warbler	*Dendroica castanea*
Cerulean warbler	*Dendroica cerulea*
Yellow-rumped warbler	*Dendroica coronata*
Prairie warbler	*Dendroica discolor*
Yellow-throated warbler	*Dendroica dominica*
Blackburnian warbler	*Dendroica fusca*
Magnolia warbler	*Dendroica magnolia*
Palm warbler	*Dendroica palmarum*
Chesnut-sided warbler	*Dendroica pensylvanica*
Yellow warbler	*Dendroica petechia*
Pine warbler	*Dendroica pinus*
Blackpoll warbler	*Dendroica striata*
Cape May warbler	*Dendroica tigrina*
Black-throated green warbler	*Dendroica virens*
Black-throated blue warbler	*Dendroica caerulescens*
Common yellowthroat	*Geothlypis trichas*
Worm-eating warbler	*Helmitheros vermivorus*
Yellow-breasted chat	*Icteria virens*
Black and white warbler	*Mniotilta varia*
Connecticut warbler	*Oporornis agilis*
Kentucky warbler	*Oporornis formosus*
Mourning warbler	*Oporornis philadelphia*
Northern parula warbler	*Parula americana*

TABLE E-1
Wildlife Expected or Known to Occur at Fort Belvoir

Common Name	Scientific Name
Prothonotary warbler	*Protonotaria citrea*
Ovenbird	*Seiurus aurocapillus*
Louisiana waterthrush	*Seiurus motacilla*
Northern waterthrush	*Seiurus noveboracensis*
American redstart	*Setophaga ruticilla*
Orange-crowned warbler	*Vermivora celata*
Golden-winged warbler	*Vermivora chrysoptera*
Tennessee warbler	*Vermivora peregrina*
Blue-winged warbler	*Vermivora pinus*
Nashville warbler	*Vermivora ruficapilla*
Canada warbler	*Wilsonia candensis*
Hooded warbler	*Wilsonia citrina*
Wilson's warbler	*Wilsonia pusilla*
Scarlet tanager	*Piranga olivacea*
Summer tanager	*Piranga rubra*
Northern cardinal	*Cardinalis cardinalis*
Evening grosbeak	*Hesperiphona vespertina*
Blue grosbeak	*Guiraca caerulea*
Indigo bunting	*Passerina cyanea*
Rose-breasted grosbeak	*Pheucticus ludovicianus*
White-throated sparrow	*Zonotrichia albicollis*
Dark-eyed junco	*Junco hyemalis*
Swamp sparrow	*Melospiza georgiana*
Lincoln's sparrow	*Melospiza lincolnii*
Song sparrow	*Melospiza melodia*
House sparrow	*Passer domesticus*
Savannah sparrow	*Passerculus sandwichensis*
Fox sparrow	*Passerella iliaca*
Eastern towhee	*Pipilo erythrophthalmus*
Vesper sparrow	*Pooecetes gramineus*
American tree sparrow	*Spizella arborea*
Chipping sparrow	*Spizella passerina*

TABLE E-1
Wildlife Expected or Known to Occur at Fort Belvoir

Common Name	Scientific Name
Field sparrow	*Spizella pusilla*
White-crowned sparrow	*Zonotrichia leucophrys*
Red-winged blackbird	*Agelaius phoeniceus*
Bobolink	*Dolichonyx oryzivorus*
Rusty blackbird	*Euphagus carolinus*
Northern oriole	*Icterus galbula*
Orchard oriole	*Icterus spurius*
Brown-headed cowbird	*Molothrus ater*
Common grackle	*Quiscalus quiscula*
Eastern meadowlark	*Sturnella magna*
Pine siskin	*Carduelis pinus*
House finch	*Carpodacus mexicanus*
Purple finch	*Carpodacus purpureus*
Red crossbill	*Loxia curvirostra*
White-winged crossbill	*Loxia leucoptera*
American goldfinch	*Carduelis tristis*
Semipalmated plover	*Charadrius semipalmatus*
Killdeer	*Charadrius vociferus*
Spotted sandpiper	*Actitis macularia*
Dunlin	*Calidris alpina*
Pectoral sandpiper	*Calidris melanotos*
Least sandpiper	*Calidris minutilla*
Semipalmated sandpiper	*Calidris pusilla*
Western sandpiper	*Calidris mauri*
Common snipe	*Capella gallinago*
American woodcock	*Philohela minor*
Lesser yellowlegs	*Tringa flavipes*
Greater yellowlegs	*Tringa melanoleuca*
Solitary sandpiper	*Tringa solitaria*
Black tern	*Chlidonias niger*
Herring gull	*Larus argentatus*
Laughing gull	*Larus atricilla*

TABLE E-1
Wildlife Expected or Known to Occur at Fort Belvoir

Common Name	Scientific Name
Ring-billed gull	*Larus delawarensis*
Lesser black-backed gull	*Larus fuscus*
Greater black-backed gull	*Larus marinus*
Bonaparte's gull	*Larus philadelphia*
Least tern	*Sterna albifrons*
Caspian tern	*Sterna caspia*
Forster's tern	*Sterna forsteri*
Common tern	*Sterna hirundo*
Common bobwhite	*Colinus virginianus*
Wild turkey	*Meleagris gallopavo*
Turkey vulture	*Cathartes aura*
Black vulture	*Coragyps atratus*
Cooper's hawk	*Accipiter cooperii*
Sharp-shinned hawk	*Accipiter striatus*
Red-tailed hawk	*Buteo jamaicensis*
Rough-legged hawk	*Buteo lagopus*
Red-shouldered hawk	*Buteo lineatus*
Broad-winged hawk	*Buteo platypterus*
Northern Harrier	*Circus cyaneus*
Bald eagle	*Haliaeetus leucocephalus*
Osprey	*Pandion haliaetus*
Merlin (Pigeon hawk)	*Falco columbarius*
Peregrine falcon	*Falco peregrinus*
American kestrel	*Falco sparverius*
Great-horned owl	*Bubo virginianus*
Common screech owl	*Otus asio*
Barred owl	*Strix varia*
Barn owl	*Tyto alba*
Rock dove	*Columba livia*
Mourning dove	*Zenaida macroura*
Yellow-billed cuckoo	*Coccyzus americanus*
Black-billed cuckoo	*Coccyzus erythropthalmus*

TABLE E-1
Wildlife Expected or Known to Occur at Fort Belvoir

Common Name	Scientific Name
Chuck-will's-widow	*Caprimulgus carolinensis*
Whip-poor-will	*Caprimulgus vociferus*
Common nighthawk	*Chordeiles minor*
Chimney swift	*Chaetura pelagica*
Ruby-throated hummingbird	*Archilochus colubris*
Belted kingfisher	*Megaceryle alcyon*
Red-bellied woodpecker	*Melanerpes carolinus*
Common flicker	*Colaptes auratus*
Pileated woodpecker	*Dryocopus pileatus*
Red-headed woodpecker	*Melanerpes erythocephalus*
Downy woodpecker	*Picoides pubescens*
Hairy woodpecker	*Picoides villosus*
Yellow-bellied sapsucker	*Sphyrapicus varius*
Olive-sided flycatcher	*Nuttallornis borealis*
Eastern wood pewee	*Contopus virens*
Alder flycatcher	*Empidonax alnorum*
Yellow-bellied flycatcher	*Empidonax flaviventris*
Least flycatcher	*Empidonax minimus*
Willow flycatcher	*Empidonax traillii*
Acadian flycatcher	*Empidonax virescens*
Great crested flycatcher	*Myiarchus crinitus*
Eastern phoebe	*Sayornis phoebe*
Eastern kingbird	*Tyrannus tyrannus*
Water pipit	*Anthus spinoletta*
Horned lark	*Eremophila alpestris*
Cliff swallow	*Petrochelidon pyrrhonota*
Barn swallow	*Hirundo rustica*
Purple martin	*Progne subis*
Bank swallow	*Riparia riparia*
Rough-winged swallow	*Stelgidopteryx ruficollis*
Tree swallow	*Iridoprocne bicolor*
Common crow	*Corvus brachyrhynchos*

TABLE E-1
Wildlife Expected or Known to Occur at Fort Belvoir

Common Name	Scientific Name
Fish crow	*Corvus ossifragus*
Blue jay	*Cyanocitta cristata*
Black-capped chickadee	*Parus atricapillus*
Tufted titmouse	*Parus bicolor*
Carolina chickadee	*Parus carolinensis*
Red-breasted nuthatch	*Sitta canadensis*
White-breasted nuthatch	*Sitta carolinensis*
Common loon	*Gavia immer*
Red-throated loon	*Gavia stellata*
Horned grebe	*Podiceps auritus*
Red-necked grebe	*Podiceps grisegena*
Pied-billed grebe	*Podilymbus podiceps*
Double-crested cormorant	*Phalacrocorax auritus*
American bittern	*Botaurus lentiginosus*
Great egret	*Casmerodius albus*
Snowy egret	*Egretta thula*
Least bittern	*Ixobrychus exilis*
Great blue heron	*Ardea herodias*
Green heron	*Butorides striatus*
Little blue heron	*Florida caerulea*
Black-crowned night heron	*Nycticorax nycticorax*
Yellow crowned night heron	*Nyctanassa violacea*
Canada goose	*Branta canadensis*
Snow goose	*Chen caerulescens*
Tundra swan	*Cygnus columbianus*
Wood duck	*Aix sponsa*
Pintail	*Anas acuta*
American wigeon	*Anas americana*
Northern shoveler	*Anas clypeata*
Green-winged teal	*Anas crecca*
Blue-winged teal	*Anas discors*
Mallard	*Anas platyrhynchos*

TABLE E-1
Wildlife Expected or Known to Occur at Fort Belvoir

Common Name	Scientific Name
Black duck	*Anas rubripes*
Gadwall	*Anas strepera*
Lesser scaup	*Aythya affinis*
Redhead	*Aythya americana*
Ring-necked duck	*Aythya collaris*
Greater scaup	*Aythya marila*
Canvasback	Aythya valisineria
Bufflehead	Bucephala albeola
Common goldeneye	*Bucephala albeola*
Oldsquaw	*Clangula hyemalis*
Hooded merganser	*Lophodytes cucullatus*
White-winged scoter	*Melanitta deglandi*
Surf scoter	*Melanitta perspicillata*
Common merganser	*Mergus merganser*
Red-breasted merganser	*Mergus serrator*
Ruddy duck	*Oxyura jamaicensis*
American coot	*Fulica americana*
Common moorhen	*Gallinula chloropus*
Sora	*Porzana carolina*
King rail	*Rallus elegans*
Virginia rail	*Rallus limicola*
Fish	
American brook lamprey	*Lampetra appendix*
Longnose gar	*Lepisosteus osseus*
Bowfin	*Amia calva*
American eel	*Anguilla rostrata*
Blueback herring	*Alosa aestivalis*
Alewife	*Alosa pseudoharengus*
Gizzard shad	*Dorosoma cepedianum*
Rainbow trout	*Oncorhynchus mykiss*
Bay anchovy	*Anchoa mitchilli*
Goldfish	*Carassius auratus*

TABLE E-1
Wildlife Expected or Known to Occur at Fort Belvoir

Common Name	Scientific Name
Rosyside dace	*Clinostomus funduloides*
Satinfin shiner	*Cyprinella analostana*
Spotfin shiner	*Cyprinella spilopterus*
Common carp	*Cyprinus carpio*
Cutlips minnow	*Exoglossum maxillingua*
Common shiner	*Luxilus cornutus*
Eastern silvery minnow	*Hybognathus regius*
River chub	*Nocomis micropogon*
Golden shiner	*Notemigonus crysoleucas*
Bridle shiner	*Notropis bifrenatus*
Spottail shiner	*Notropis hudsonius*
Swallowtail shiner	*Notropis procne*
Blacknose dace	*Rhinichthys atratulus*
Longnose dace	*Rhinichthys cataractae*
Creek chub	*Semotilus atromaculatus*
Fallfish	*Semotilus corparalis*
Quillback	*Carpoides cyprinus*
White sucker	*Catostomus commersoni*
Creek chubsucker	*Erimyzon oblongus*
Northern hog sucker	*Hypentelium nigricans*
Shorthead redhorse	*Moxostoma macrolepidotum*
Yellow bullhead	*Ameiurus natalis*
Brown bullhead	*Ictalurus nebulosus*
Channel catfish	*Ictalurus punctatus*
White catfish	*Ameiurus catus*
Atlantic needlefish	*Strongylura marina*
Eastern mudminnow	*Umbra pygmaea*
Banded killifish	*Fundulus diaphanus*
Mummichog	*Fundulus heteroclitus*
Eastern mosquitofish	*Gambusia holbrooki*
Mosquitofish	*Gambusia affinis*
Inland silverside	*Menidia beryllina*

TABLE E-1
Wildlife Expected or Known to Occur at Fort Belvoir

Common Name	Scientific Name
White perch	*Morone americana*
Striped bass	*Morone saxatilis*
Bluespotted sunfish	*Enneacanthus gloriosus*
Red breasted sunfish	*Lepomis auritus*
Green sunfish	*Lepomis cyanellus*
Pumpkinseed	*Lepomis gibbosus*
Redear sunfish	*Lepomis microlophus*
Bluegill	*Lepomis macrochirus*
Warmouth	*Leponis gulosus*
Longear sunfish	*Lepomis megalotis*
White crappie	*Pomoxis annularis*
Black crappie	*Pomoxis nigromaculatus*
Smallmouth bass	*Micropterus dolomieu*
Largemouth bass	*Micropterus salmoides*
Tessellated darter	*Etheostoma olmstedi*
Spot	*Leiostomus xanthurus*
Hogchoker	*Trinectes maculatus*
Amphibians	
Northern cricket frog	*Acris c. crepitans*
Green treefrog	*Hyla cinera*
Cope's gray treefrog	*Hyla v. chrysoscelis*
Gray treefrog	*Hyla versicolor*
Northern spring peeper	*Hyla c. crucifier*
Upland chorus frog	*Pseudacris triseriata*
Green frog	*Rana c. clamitans*
Bullfrog	*Rana catesbeiana*
Pickerel frog	*Rana palustris*
Wood frog	*Rana sylvatica*
Southern leopard frog	*Rana u. utricularia*
American toad	*Bufo a. americanus*
Woodhouse's toad	*Bufo woodhousii*
Eastern spadefoot	*Scaphiopus h. holbrookii*

TABLE E-1
Wildlife Expected or Known to Occur at Fort Belvoir

Common Name	Scientific Name
Jefferson's salamander	*Ambystoma jeffersonianum*
Spotted salamander	*Ambystoma maculatum*
Marbled salamander	*Ambystoma opacum*
Northern dusky salamander	*Desmognathus f. fuscus*
Northern two-lined salamander	*Eurycea b. bislineata*
Three-lined salamander	*Eurycea guttolineata*
Longtail salamander	*Eurycea longicauda*
Four-toed salamander	*Hemidactylum scutatum*
Red-spotted newt	*Notophthalmus v. viridescens*
Red back salamander	*Plethodon cinereus*
White-spotted salamander	*Plethodon punctatus*
Eastern mud salamander	*Pseudotriton m. montanus*
Northern red salamander	*Pseudotriton r. ruber*
Reptiles	
River cooter	*Pseudemys concinna*
Eastern box turtle	*Terrapene c. carolina*
Eastern mud turtle	*Kinosternon s. subrubrum*
Painted turtle	*Chrysemys picta*
Common snapping turtle	*Chelydra s. serpentina*
Red bellied turtle	*Chrysemys rubriventris*
Spotted turtle	*Clemmys guttata*
Wood turtle	*Clemmys insculpta*
Eastern musk turtle	*Sternotherus odoratus*
Pond slider turtle	*Trachemys scripta*
Timber rattlesnake	*Crotalus horridus*
Northern copperhead	*Agkistrodon contortrix mokasen*
Eastern worm snake	*Carphophis a. amoenus*
Northern black racer	*Coluber c. constrictor*
Northern ringneck snake	*Diadolphis punctatus*
Corn snake	*Elaphe g. guttata*
Black rat snake	*Elaphe o. obsoleta*
Eastern hognose snake	*Heterodon platyrhinos*

TABLE E-1
Wildlife Expected or Known to Occur at Fort Belvoir

Common Name	Scientific Name
Eastern kingsnake	*Lampropeltis g. getulus*
Milksnake	*Lampropeltis triangulum*
Mole Kingsnake	*Lampropeltis calligaster*
Northern water snake	*Nerodia s. sipedon*
Eastern rough green snake	*Opheodrys a. aestivus*
Queen snake	*Regina septemvittata*
Northern brown snake	*Storeria d. dekayi*
Northern redbelly snake	*Storeria o. occipitomaculata*
Eastern ribbon snake	*Thamnophis s. sauritis*
Eastern garter snake	*Thamnophis s. sirtalis*
Smooth earth snake	*Virginia v. valeriae*
Five-lined skink	*Eumeces fasciatus*
Broad-headed skink	*Eumeces laticeps*
Northern fence lizard	*Sceloporus undulatus hyacinthinus*
Ground skink	*Scincella lateralis*

Appendix F
Agency Correspondence

DEPARTMENT OF THE ARMY
U. S. ARMY GARRISON, FORT BELVOIR
DIRECTORATE OF PUBLIC WORKS AND LOGISTICS
9430 JACKSON LOOP, SUITE 100
FORT BELVOIR, VIRGINIA 22060-5116

REPLY TO
ATTENTION OF

April 2, 2003

Karen Mayne
U. S. Fish and Wildlife Service
Ecological Services
6669 Short Lane
Gloucester, VA 23061

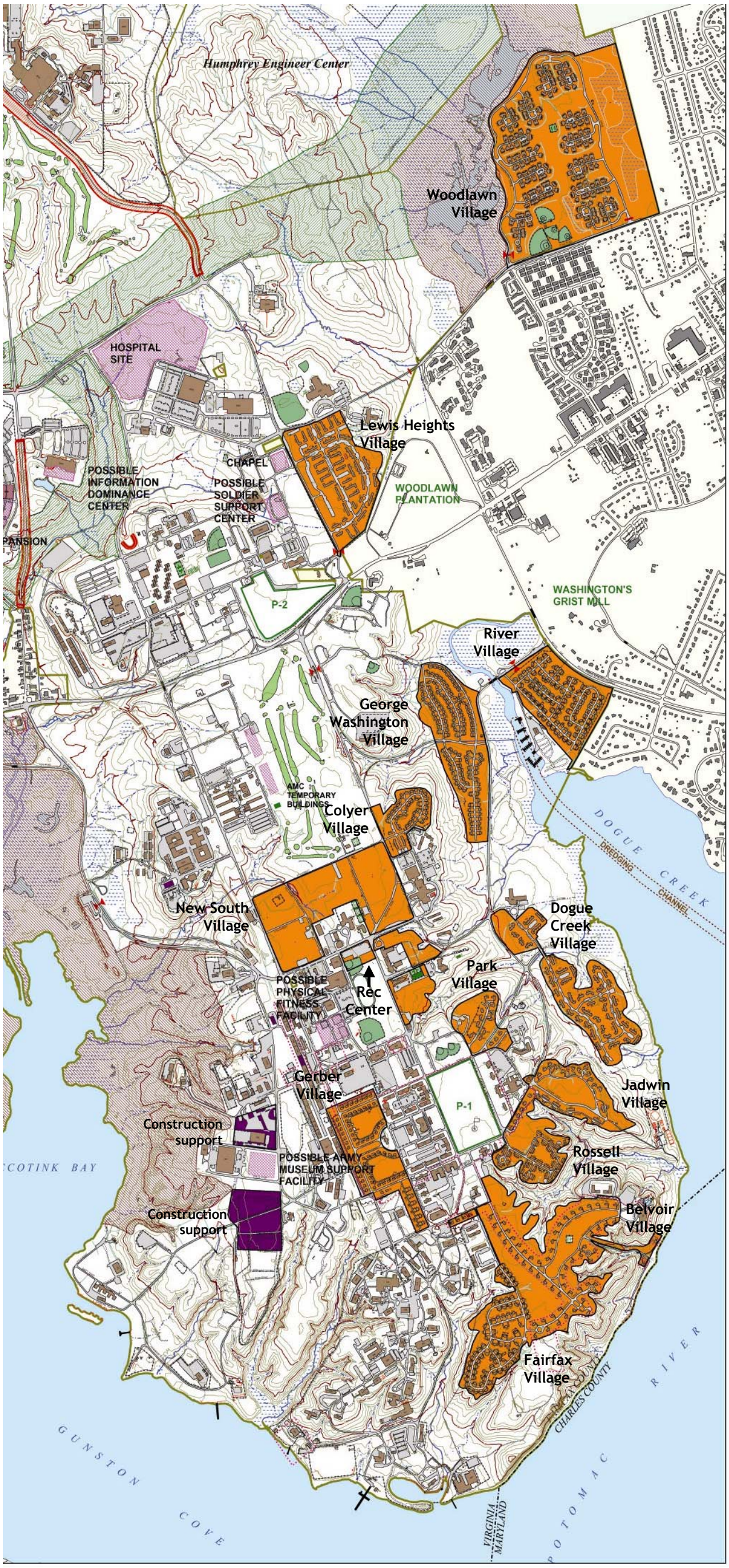
Dear Ms. Mayne:

A letter and map were sent to you on September 3, 2002 requesting Rare, Threatened, and Endangered Species information to support the Army's Environmental Assessment (EA) for the Residential Communities Initiative (RCI) project at Fort Belvoir, Virginia (Enclosure 1).

Since the original letter was sent to you, the acreage proposed to be leased to Clark-Pinnacle Family Communities LLC (Clark Pinnacle), Fort Belvoir's RCI development partner, for operation and reconstruction/rehabilitation of Army family housing has been revised and slightly increased. Small adjustments have been made to the RCI housing sites. In addition, the "RCI Development" parcel near Pence Gate (see September 2002 site map in Enclosure 1) has been replaced by the parcel at the center of Fort Belvoir's South Post. This new parcel is proposed for use as construction swing space for a New South Village to accommodate residents while existing villages are being rehabilitated or replaced. A new family recreation center is also proposed to be built at this location. In addition, two sites have been identified for temporary construction support facilities (construction offices, lumber yard, equipment storage, concrete plant and stone crushing) that will not be leased, and will only be used during the construction phase. Enclosure 2 (dated March 2003) presents the revised RCI site map.

Based upon your response letter dated October 3, 2002 (Enclosure 3), conversations during the March 5, 2003 Environmental Agency Meeting at Fort Belvoir, and a telephone conversation between Andy Moser (U.S. Fish and Wildlife Service (USFWS) and Dorothy Keough (Fort Belvoir) on March 24, 2003, the Army proposes to conduct site-specific surveys for the small whorled pogonia (Isotria medeoloides) in the undisturbed wooded portions of each RCI parcel, at an appropriate time prior to any land disturbance at that parcel.

Several RCI parcels are scheduled for construction within the first couple of years after leasing to Clarke Pinnacle: demolition and construction in Rossell Village and Lewis Heights Village, new construction in New South Village (the swing space),



DISCLAIMER: This concept map is intended for long-range concept planning purposes only. All concepts, projects, and ideas shown on this map represent installation planning concepts only. They do not necessarily indicate approval at any organizational level above installation. It should not be inferred that these projects, ideas, and concepts have been presented to any or all levels above installation. The information on this map is only current as of the date indicated.

MASTER PLANNING
RCI NEPA ANALYSIS MAP
26 MAR, 2003 EDITION
FORT BELVOIR, VIRGINIA

The Army requests your concurrence with the above approaches for addressing these species in the RCI project and its associated EA. In addition, we request any information you may have regarding rare, threatened, and endangered species in the new parcels added to the RCI project. We would appreciate your response within 30 days of receipt of this letter.

If you have any questions or need additional information, please call Dorothy Keough at 703-806-0049.

Sincerely,

Kevin W. Tate
Lieutenant Colonel, U.S. Army
Director of Public Works and Logistics

3 Enclosures

Copies Furnished:

Deputy Garrison Commander, U.S. Army Garrison, Fort Belvoir
Residential Communities Initiative Office, Fort Belvoir
Public Affairs Office, U.S. Army Garrison, Fort Belvoir
Andy Moser, U.S. Fish and Wildlife Service
Kim Marbain, U.S. Fish and Wildlife Service
Craig Koppie, U.S. Fish and Wildlife Service

DEPARTMENT OF THE ARMY
U. S. ARMY GARRISON, FORT BELVOIR
DIRECTORATE OF PUBLIC WORKS AND LOGISTICS
9430 JACKSON LOOP, SUITE 100
FORT BELVOIR, VIRGINIA 22060-5116

REPLY TO
ATTENTION OF

April 2, 2003

Timothy Goodger
National Marine Fisheries Service
Oxford Habitat Conservation Field Office
904 South Morris St
Oxford, MD 21654

Dear Mr. Goodger:

The Army is preparing an Environmental Assessment (EA) for the Residential Communities Initiative (RCI) project at Fort Belvoir, Virginia.

The Army proposes to convey the existing family housing units in 12 existing housing villages and to provide a 50-year land lease of the underlying land parcels and of one additional development parcel (about 650 acres in all), to Clark-Pinnacle Family Communities LLC (Clark-Pinnacle), Fort Belvoir's development partner. In addition, two sites have been identified for temporary construction support facilities (construction offices, lumber yard, equipment storage, concrete plant and stone crushing) that will not be leased, and will only be used during the construction phase. Clark-Pinnacle will operate and maintain all Army family housing and related amenities to support activities related to family housing such as community centers, recreation centers, etc. on Fort Belvoir and, over a number of years, will rehabilitate or replace the existing housing units. An additional parcel at the center of Fort Belvoir's South Post is proposed for use as construction swing space ("New South Village") to accommodate residents while existing villages are being rehabilitated or replaced.

The affected parcels on Fort Belvoir are identified on the enclosed map (Enclosure 1). For context, an area map is also enclosed (Enclosure 2). The EA will review the potential environmental effects of the proposed action, including potential threats to the continued existence of threatened and endangered species or the destruction or adverse modification of critical habitat.

We would like to solicit any comments you may have regarding essential fish habitat or other marine resources in relation to the proposed action. We would greatly appreciate receiving the information within 30 days of your receipt of this letter.

Annadromous fish surveys conducted by the Army on and around Fort Belvoir indicate that alewife (Alosa pseudoharengus), striped bass (Morone saxatilis), and blueback herring (Alosa aestivalis) occur in the larger waterways adjacent to Fort Belvoir (e.g., Potomac River, Dogue Creek, Gunston Cove, Accotink Bay/Creek and Pohick Bay/Creek). There is no indication that habitat for these species occurs interior to Fort Belvoir on any of the RCI parcels. Therefore, no further surveys for these species will be conducted for the RCI project.

If you have any questions or need additional information, please contact Dorothy Keough at 703-806-0049.

Sincerely,

Kevin W. Tale
Lieutenant Colonel
Director of Public Works and Logistics

2 Enclosures

Copies Furnished w/o Enclosures:

Deputy Garrison Commander, Fort Belvoir
Residential Communities Initiative Office, Fort Belvoir
Public Affairs Office, U.S. Army Garrison, Fort Belvoir
Staff Judge Advocate, Fort Belvoir

DEPARTMENT OF THE ARMY
U. S. ARMY GARRISON, FORT BELVOIR
DIRECTORATE OF PUBLIC WORKS AND LOGISTICS
9430 JACKSON LOOP, SUITE 100
FORT BELVOIR, VIRGINIA 22060-5116

REPLY TO
ATTENTION OF

April 2. 2003

Chris Hobson
Virginia Department of Conservation and Recreation
Division of Natural Heritage
217 Governor Street, 3rd Floor
Richmond, VA 23219

Dear Mr. Hobson:

A letter and map were sent to your agency on September 3, 2002 requesting Rare, Threatened, and Endangered Species information to support the Army's Environmental Assessment (EA) for the Residential Communities Initiative (RCI) project at Fort Belvoir, Virginia (Enclosure 1).

Since the original letter was sent to you, the acreage proposed to be leased to Clark-Pinnacle Family Communities LLC (Clark-Pinnacle), Fort Belvoir's development partner, for operation and reconstruction/rehabilitation of Army family housing has been revised and slightly increased. Small adjustments have been made to the RCI housing sites. In addition, the "RCI Development" parcel near Pence Gate (see September 2002 site map in Enclosure 1) has been replaced by a new parcel at the center of Fort Belvoir's South Post. This new parcel is proposed for use as construction swing space for a New South Village to accommodate residents while existing villages are being rehabilitated or replaced. A new family recreation center is also proposed to be built at this location. In addition, two sites have been identified for temporary construction support facilities (construction offices, lumber yard, equipment storage, concrete plant and stone crushing) that will not be leased, and will only be used during the construction phase. Enclosure 2 (dated March 26 2003) presents the revised RCI site map.

Based upon your response letter dated September 19, 2002 (Enclosure 3), and conversations during the March 5, 2003 and December 4, 2002 Environmental Agency Meetings at Fort Belvoir, Fort Belvoir is presently conducting a groundwater/hydrological study and survey for the Northern Virginia well amphipod (*Stygobromus phreaticus*) in the Tompkins Basin and T-17 areas, which are not in but are near the RCI project footprint. This survey also includes biological sampling of groundwater seeps and groundwater samples from the wells in the study area. The intent of the survey is to assess the potential extent of the amphipod in this part of the installation.

A question was raised in the March 5, 2003 meeting about inclusion of the Dogue Creek Marina in the proposed RCI project. After further consideration, Fort Belvoir has made a decision to withdraw the marina land from the RCI project and will not lease the marina to Clark-Pinnacle. Fort Belvoir will continue to operate the existing marina.

The Army requests any further comments you have and would appreciate your response within 30 days of your receipt of this letter. If you have any questions or need additional information, please contact Dorothy Keough at 703-806-0049.

Sincerely,

Kevin W. Tate
Lieutenant Colonel
Director of Public Works and Logistics

3 Enclosures

Copies Furnished:

Deputy Garrison Commander, U.S. Army Garrison, Fort Belvoir
Residential Communities Initiative Office, Fort Belvoir
Public Affairs Office, U.S. Army Garrison, Fort Belvoir
Staff Judge Advocate, U.S. Army Garrison, Fort Belvoir

DEPARTMENT OF THE ARMY
U. S. ARMY GARRISON, FORT BELVOIR
DIRECTORATE OF PUBLIC WORKS AND LOGISTICS
9430 JACKSON LOOP, SUITE 100
FORT BELVOIR, VIRGINIA 22060-5116

REPLY TO
ATTENTION OF

April 2, 2003

Brian Moyer
Virginia Department of Game and Inland Fisheries
Environmental Services Section
4010 West Broad Street
Richmond, VA 23230

Dear Mr. Moyer:

A letter and map were sent to your agency on September 3, 2002 requesting Rare, Threatened, and Endangered Species information to support the Army's Environmental Assessment (EA) for the Residential Communities Initiative (RCI) project at Fort Belvoir, Virginia (Enclosure 1).

Since the original letter was sent to you, the acreage proposed to be leased to Clark-Pinnacle Family Communities LLC (Clark-Pinnacle), Fort Belvoir's development partner, for operation and reconstruction/rehabilitation of Army family housing has been revised and slightly increased. Small adjustments have been made to the RCI housing sites. In addition, the "RCI Development" parcel near Pence Gate (see September 2002 site map in Enclosure 1) has been replaced by the parcel at the center of Fort Belvoir's South Post. This new parcel is proposed for use as construction swing space for a New South Village to accommodate residents while existing villages are being rehabilitated or replaced. A new family recreation center is also proposed to be built at this location. In addition, two sites have been identified for temporary construction support facilities (construction offices, lumber yard, equipment storage, concrete plant and stone crushing) that will not be leased, and will only be used during the construction phase. Enclosure 2 presents the revised RCI site map.

Based upon your response letter dated September 11, 2002 (Enclosure 3), and conversations during the March 5, 2003 and December 4, 2002 Environmental Agency Meetings at Fort Belvoir, the following steps will be taken to ensure protection of any state-listed species.

Portions of the project area fall within designated bald eagle (*Haliaeetus leucocephalus*) foraging areas along Fort Belvoir's shoreline of the Potomac River and Dogue Creek. Pursuant to the Fort Belvoir Bald Eagle Management Plan (Paciulli, Simmons & Associates, Ltd. 2000, and incorporated into the 2001 Fort Belvoir Integrated Natural Resources Management Plan), these foraging areas will be protected by enforcing the 750-foot linear buffer from the shoreline inland. (This buffer accounts for previously developed areas).

On March 12, 2003, Craig Koppie of U.S. Fish and Wildlife Service (USFWS), visited Fort Belvoir and confirmed the presence of an active bald eagle nest along the Dogue Creek shoreline of the Fort Belvoir peninsula, immediately adjacent to Dogue Creek Village, (an RCI parcel). Undeveloped land around the nest that previously fell within the RCI footprint has been removed from the current footprint. In order to protect this nest, and in accordance with federal and state law and Fort Belvoir policy, the Army will establish and maintain a primary nest

protection zone (750 feet) and a secondary nest protection zone (from 750 to 1,320 feet) around this new nest. The Army will coordinate with USFWS and Virginia Department of Game and Inland Fisheries (DGIF) to develop the restrictions for these areas. Such restrictions must take into account that developed land uses already exist within those areas. It is understood that they will include restrictions on activity within the protection zones during the breeding season, protection of the existing forest vegetation around the site, and establishment and maintenance of vegetated buffers.

An installation-wide survey for the wood turtle (*Clemmys insculpta*) was conducted by Dr. Joseph Mitchell at Fort Belvoir in 2002. It is the Army's understanding from the December 4, 2002 agency meeting at Fort Belvoir and from an e-mail correspondence between Jeff Cooper (VDGIF) and Dorothy Keough (Fort Belvoir) on January 7, 2003, no further surveys are required for wood turtle.

Anadromous fish surveys conducted by the Army on and around Fort Belvoir indicate that alewife (*Alosa pseudoharengus*), striped bass (*Morone saxatilis*), and blueback herring (*Alosa aestivalis*) occur in the larger waterways adjacent to Fort Belvoir (e.g., Potomac River, Dogue Creek, Gunston Cove, Accotink Bay/Creek and Pohick Bay/Creek). Therefore, no further surveys for these species will be conducted for the RCI project.

A question was raised in the March 5, 2003 meeting about inclusion of the Dogue Creek Marina on the proposed RCI project. After further consideration, Fort Belvoir has made a decision to withdraw the marina land from the RCI project and will not lease the marina to Clark-Pinnacle. Fort Belvoir will continue to operate the existing marina.

The Army requests your concurrence with the above approaches for addressing these species in the RCI project and its associated EA. In addition, we request any information you may have regarding rare, threatened, and endangered species in the new parcels added to the RCI project. We would appreciate your response within 30 days of your receipt of this letter. If you have any questions or need additional information, please call Dorothy Keough at 703-806-0049.

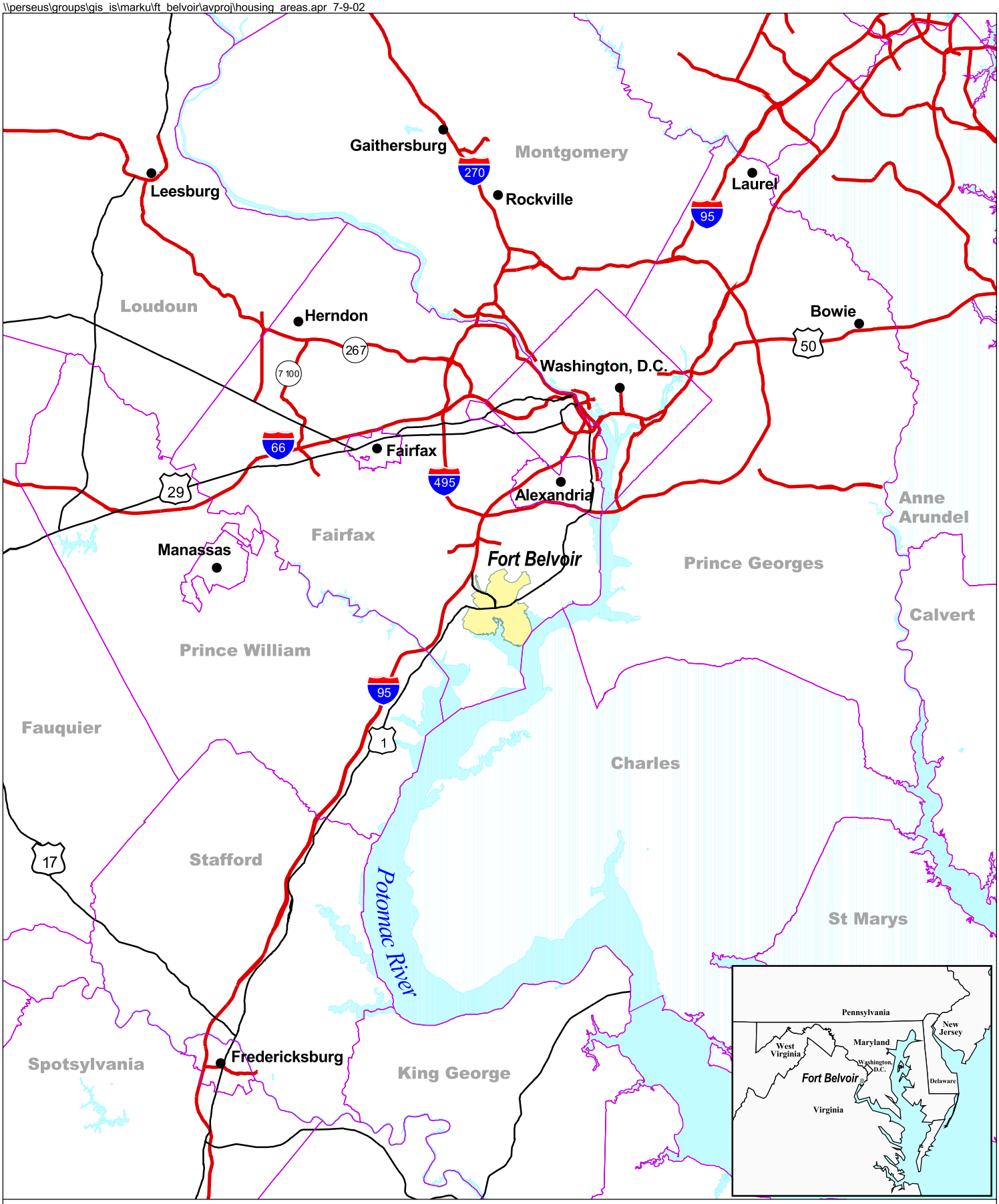
Sincerely,

Kevin W. Tate
Lieutenant Colonel
Director of Public Works and Logistics

3 Enclosures

Copies Furnished:

Deputy Garrison Commander, U.S. Army Garrison, Fort Belvoir
Residential Communities Initiative Office, Fort Belvoir
Public Affairs Office, U.S. Army Garrison, Fort Belvoir
Staff Judge Advocate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Gaithersburg
Montgomery
Leesburg
Rockville
Laurel
Loudoun
Herndon
Bowie
Washington, D.C.
Fairfax
Alexandria
Anne Arundel
Manassas
Fairfax
Fort Belvoir
Prince Georges
Calvert
Prince William
Fauquier
Charles
Stafford
Potomac River
St Marys
Spotsylvania
Fredericksburg
King George
270
95
267
7100
66
495
29
50
1
17
Pennsylvania
New Jersey
West Virginia
Maryland
Washington, D.C.
Fort Belvoir
Delaware
Virginia
City / County Boundaries
Major Roads
Fort Belvoir
Water Bodies
N
0 4 8 12 16 20 Miles
Figure 1-1
Installation Location
RCI EA
Fort Belvoir, Virginia
CH2MHILL

W. Tayloe Murphy, Jr.
Secretary of Natural Resources

Joseph H. Maroon
Director

COMMONWEALTH of VIRGINIA

DEPARTMENT OF CONSERVATION AND RECREATION

217 Governor Street
Richmond, Virginia 23219-2010
Telephone (804) 786-7951 FAX (804) 371-2674 TDD (804) 786-2121

May 12, 2003

Kevin W. Tate
Lieutenant Colonel
Department of the Army
9430 Jackson Loop, Suite 100
Fort Belvoir, VA 22060

Re: Residential Communities Initiative (RCI) Housing Sites

Dear Col. Tate:

The Department of Conservation and Recreation's Division of Natural Heritage (DCR) has searched its Biological and Conservation Data System (BCD) for occurrences of natural heritage resources from the areas outlined on the submitted map. Natural heritage resources are defined as the habitat of rare, threatened, or endangered species, unique or exemplary natural communities, and significant geologic formations.

Regarding the current plans for the RCI housing sites, BCD documents the presence of natural heritage resources within a two-mile radius of the project area. However, due to the scope of the activity and the distance to the resources, DCR does not anticipate any adverse impacts to these natural heritage resources, with the possible exception of Northern Virginia well amphipod (*Stygobromus phreaticus*, G1/S1/NF/NS).

Currently, there is a groundwater/hydrologic study and survey for the Northern Virginia well amphipod in progress. The potential impacts to the Northern Virginia well amphipod are yet to be determined pending completion of the present analysis.

Regarding future plans for RCI housing sites, DCR requests that the Department of the Army coordinate with our Division of Natural Heritage in the event that further development for this area is proposed.

Under a Memorandum of Agreement established between the Virginia Department of Agriculture and Consumer Services (VDACS) and the Virginia Department of Conservation and Recreation (DCR), DCR represents VDACS in comments regarding potential impacts on state-listed threatened and endangered plant and insect species. The current activity will not affect any documented state-listed plants or insects.

Any absence of data may indicate that the project area has not been surveyed, rather than confirm that the area lacks other natural heritage resources. New and updated information is continually added to BCD.

Please contact DCR for an update on this natural heritage information if a signi ficant amount of time passes before it is utilized.

Should you have any questions or concerns, feel free to contact me at 804-692-0984. Thank you for the opportunity to comment on this project.

Sincerely,

Elizabeth Locklear
Locality Liaison

CC: Andy Moser, USFWS
Brian Moyer, VDGIF

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Chesapeake Bay Field Office
177 Admiral Cochrane Drive
Annapolis, MD 21401

June 18, 2003

Kevin W. Tate
Lieutenant Colonel
Department of the Army
9430 Jackson Loop, Suite 100
Fort Belvoir, VA 22060

RE: Residential Communities Initiative (RCI) Housing sites

Dear Colonel Tate:

This letter responds to your April 2, 2002, request for updated information on Federally listed or proposed endangered or threatened species for the referenced project, which has been modified as described in your letter and shown on your March 2003 map, received in this office on June 17, 2003. Since the Service's previous endangered species list response letter of October 3, 2002, we understand that the RCI project has been modified as follows:

The "RCI development" parcel near Pence Gate has been replaced by the parcel at the center of Fort Belvoir's South Post. This new parcel is proposed for use as construction swing space for a New South Village to accommodate residents while existing villages are being rehabilitated or replaced. A new family recreation center is also proposed to be built at this location. In addition, two new sites have been identified for temporary construction support facilities. In response to Service recommendations to protect nesting bald eagles (*Haliaeetus leucocephalus*), the RCI footprint for Dogue Creek Village has been modified so that undeveloped land around the eagle nest that previously fell within the RCI footprint, has been removed from the current footprint. The Army has also agreed to time-of-year restrictions on activity in protection zones around the nest, protection of existing forest vegetation around the site, and establishment and maintenance of vegetated buffers.

It is also our understanding that Fort Belvoir has made a decision to withdraw the marina land from the RCI project and will not lease the marina to Clark-Pinnacle, Fort Belvoir's RCI development partner. Fort Belvoir will continue to operate the existing marina.

As we have indicated in previous discussions with your staff, two Federally listed species may be present in the area affected by this project: the bald eagle and the small whorled pogonia (*Isotria medeoloides*). In addition, a Federal species of concern, the Northern Virginia well amphipod

(*Stygobromus phreaticus*) is known to occur on Fort Belvoir. The Service has been petitioned to list or emergency list this groundwater dependent species, which is currently known to be extant at only a single site--a seep on Fort Belvoir.

You have also requested concurrence with the Army's approaches, described in your April 2 letter, for addressing these species in the RCI project and its associated EA. We are in concurrence with the approach being taken in the RCI project, as described above, to protect nesting bald eagles. We are also in concurrence with your approach to protecting the small whorled pogonia, provided that you commit to consulting (formally or informally, as appropriate) with the Service prior to finalizing and proceeding with your plans for RCI in any of the surveyed woodland areas which are found to support this species. For the well amphipod, we agree with the Army's approach concerning studies currently underway to determine the distribution of the species and to study the groundwater/hydrology on which it depends, but recognize that potential impacts to this amphipod cannot be determined until the current studies have been completed.

Thank you for the opportunity to comment. If you have any questions concerning this response, please contact Andy Moser at (410) 573-4537.

Sincerely,

Mary Ratnaswamy

Mary J. Ratnaswamy, Ph.D.
Program Supervisor, Endangered Species

cc: Chris Hobson, VADCR
Craig Koppie, CBFO
Karen Mayne, VAFO

DEPARTMENT OF THE ARMY
U.S. ARMY GARRISON, FORT BELVOIR
DIRECTORATE OF INSTALLATION SUPPORT
9430 JACKSON LOOP, SUITE 107
FORT BELVOIR, VIRGINIA 22060-5130

REPLY TO
ATTENTION OF

Environmental and Natural
Resource Division

MAR 2003

Mr. Marc Holma
Architectural Historian
Review and Compliance
Virginia Department of Historic Resources
2801 Kensington Avenue
Richmond, Virginia 23221

RE: Implementation of Residential Communities Initiative
US Army Garrison Fort Belvoir, Virginia

Dear Mr. Holma:

In accordance with the provisions of 36 CFR Part 800.6(a), we are notifying you of our intention to initiate consultation with your office regarding resolution of adverse effects associated with the implementation of the United States Army Residential Communities Initiative (RCI) at Fort Belvoir, Virginia. We will also notify the Advisory Council on Historic Preservation (ACHP) of the potential adverse effect finding and invite them to participate in the consultation in accordance with 36 CFR Part 800.6(a)(1).

The purpose of the RCI program is to privatize 761 current housing resources (2,070 Army Family Housing [AFH] units, eleven garages) and to construct additional housing buildings at Fort Belvoir. One hundred forty-eight National Register-eligible resources are included in the RCI project area, as are 63 resources currently under review by your office for determination of eligibility (256 AFH units, eleven garages).

Furthermore, adverse effects to 410 Capehart-Wherry Era housing buildings (1370 AFH units) included in the RCI program at Fort Belvoir are covered under the "Program Comment for Capehart and Wherry Era Family Housing and Associated Structures and Landscape Features (1949-62)," recently adopted by the Advisory Council on Historic Preservation (ACHP) and are not the subject of this consultation. The remaining 142 housing buildings (444 AFH units) on Fort Belvoir were constructed in 1980-1981, do not possess any significant features or associations with the past to justify consideration for eligibility for properties not yet 50 years of age, and are not the subject of this consultation.

Forty-nine archaeological sites are located in the Fort Belvoir RCI project area. Of these, three have been determined eligible, 23 potentially eligible, and 23 not eligible for listing in the National Register.

Description of the Undertaking

Under the RCI program, Fort Belvoir proposes to convey to Clark-Pinnacle Family Communities, LLC (Clark-Pinnacle), the selected RCI developer/partner, its entire inventory of 752 family housing buildings and eleven detached garages (Attachment A includes a listing of all resources eligible and potentially-eligible in the RCI project area, listed by Village for historic resources, and by eligibility for archaeological resources), comprised of:

148 National Register-eligible resources in Belvoir, Gerber, and Jadwin Villages,
63 potentially eligible resources at Russell, Park and Jadwin Villages,
410 Capehart-Wherry Era (1949-1962) buildings in River, Colyer, Fairfax, George Washington, Dogue Creek and Lewis Heights Villages, and
142 modern (1980-1981) buildings in Woodlawn Village.

The Army will lease the land on which the existing houses are located and any additional installation lands for new construction identified by the installation to Clark-Pinnacle. In exchange, Clark-Pinnacle will provide for new construction, renovation or rehabilitation of the housing and community amenities, as well as long-term operation, management, maintenance and rehabilitation of this inventory for a 50-year lease term with a 25-year renewal clause.

It is anticipated that Clark-Pinnacle will rehabilitate all 148 resources currently identified as National Register-eligible conveyed to them in the privatization process, and five brick town homes built in 1939 in Jadwin Village currently under review for determination of eligibility by your office.

It is also anticipated that Clark-Pinnacle will demolish most, if not all, of the remaining resources currently under review for determination of eligibility by your office, and replace these resources with modern housing. This includes the following:

14 Wood housing units built in 1920-21 in Jadwin Village
14 Wood housing units built in 1920-21 in Park Village
30 Duplex brick buildings built in 1947-48 in Russell Village

Level and Nature of Federal Involvement

The Defense Authorization bill (Public Law 104-106) as codified in 10 U.S.C. 2871 et seq. includes provisions collectively known as the Military Housing Privatization Initiative, which provides the Services with alternative authorities for construction and improvement of military housing. Under these authorities, the Services can leverage appropriated housing construction funds and government-owned assets to attract private capital in an effort to improve the quality of life for soldiers and their families.

Area of Potential Effect (APE)

The proposed APE for architectural and landscape resources for this project coincides with five family housing neighborhoods on Fort Belvoir, including Belvoir Village, Gerber Village, Russell Village,

Park Village and Jadwin Village and the proposed locations of new construction at the installation.

Impacts to the Capehart Wherry units at Deque Creek Village, Colyer Village, George Washington Village, River Village and Lewis Heights Village are covered under the Program Comment and are not subject of this consultation as noted above. Similarly, modern units in Woodlawn Village are not the subject of this consultation.

The APE for archaeological resources is defined as all RCI project areas on the installation. Attachment B illustrates the APE for historic resources, and Attachment C illustrates the APE for and archaeological resources.

Identification of Historic Properties

Multiple cultural resources studies have been undertaken at Fort Belvoir, resulting in the identification of historically significant archaeological and architectural resources including the National Register-eligible and Virginia Landmark-listed Fort Belvoir Historic District, the US Army Package Power Reactor, the Camp A. A. Humphreys Pump Station and Filter Building and the Thermo-Dan House.

The Fort Belvoir Historic District encompasses 181 contributing and 17 non-contributing resources, including residential and non-residential properties. The majority of buildings within the district were constructed between the 1920s-1940s. All historic family housing at Belvoir and Gerber Villages, and a portion of Jadwin Village, are included within the district boundaries.

Three additional historic housing areas are in the determination of eligibility process in accordance with Section 110 (16 U.S.C. 470h-2(a)) of the National Historic Preservation Act. For the purposes of this consultation, we are identifying these properties as potentially eligible and as potential contributing resources to the Fort Belvoir Historic District. These areas include housing at Rossell, Park, and Jadwin Villages.

In 1992, *Historic Components Guidebooks* governing the treatment of selected historic houses at Fort Belvoir were prepared for Quarters 2-60, 67 and 68 at Belvoir Village and 101-171 at Gerber Village. Quarters 1 was not included in the guidebook for Belvoir Village, and Quarters 500-503 and Garages 173-178 were not included in the Gerber Village guidebook. In addition, in 2001, a *Maintenance Plan* was prepared on 32 buildings within the Fort Belvoir Historic District ranging from administrative buildings to engineer company barracks/offices.

Furthermore, archaeological resources at Fort Belvoir have been investigated for over 70 years, resulting in the identification of over 300 archaeological sites. The Belvoir Manor Ruins and Fairfax Gravesites are listed on the National Register. Furthermore, a disturbance study, historic context and archaeological reconnaissance and identification study for all previously unsurveyed and undisturbed areas of the installation has been prepared. In 1994, VDHR confirmed that Fort Belvoir had satisfactorily completed archaeological identification studies for the installation.

Finally, in 2001, an *Integrated Cultural Resources Management Plan* was prepared to assist the installation in its stewardship of cultural and historic resources within its boundaries.

Potential Effects on Historic Properties

In accordance with 36 CFR Part 800, conveyance of the 210 National Register-eligible and potentially-eligible resources will have an adverse effect on the Fort Belvoir Historic District. Additionally, demolition of potentially-eligible resources will have an adverse effect on the Fort Belvoir Historic District.

By copy of this letter we are requesting your concurrence with our determination that, in accordance with 36 CFR Part 800.5, the sale and subsequent treatment of historic family housing units at Fort Belvoir, lease of ground upon which they sit and the potential impact of new construction on archaeological sites will have an adverse effect on properties eligible for listing in the National Register.

Public Involvement

Fort Belvoir will notify multiple local government agencies, historic preservation organizations and religious organizations via letter concerning a discussion of the proposed undertaking, the significance of the resources, and a summary of the Section 106 review process along point of contact information for the project.

Government Agencies

Fairfax County Department of Planning & Zoning, Fairfax, VA
Fairfax County Planning Commission, Fairfax, VA
Fairfax County Archaeologist, Herndon, VA
Fairfax City Regional Library, Virginia Room, Fairfax, VA
Fairfax County Public Library, Fairfax, VA
City of Alexandria Department of Planning & Zoning, Alexandria, VA
Office of Historic Alexandria, Alexandria, VA

Historic Preservation Organizations

The National Trust for Historic Preservation, Washington, DC
The Preservation Alliance of Virginia, Richmond, VA
Fairfax Genealogical Society, Merrifield, VA
Fairfax County History Commission, Fairfax, VA
Gum Springs Historical Society, Alexandria, VA

Religious Organizations

Pohick Church, Lorton, VA
Society of Friends, Alexandria Monthly Meeting, Alexandria, VA
Woodlawn Baptist Church, Alexandria, VA

Historic Properties

Woodlawn Plantation, Mount Vernon, VA
Mount Vernon, Mount Vernon, VA
George Washington's Grist Mill, Alexandria, VA

Gunston Hall Plantation, Mason Neck, VA

Consultation

After receipt of your concurrence with our determination of adverse effect, in accordance with 36 CFR Part 800.6(a)(1), we will notify the ACHP of our determination and invite them to participate in the consultation process. If we do not hear from the ACHP within fifteen days of receipt of notification, we will continue consultation with your office absent ACHP participation.

Fort Belvoir will attempt to mitigate the adverse effects by crafting a Memorandum of Agreement (MOA) based on a standardized MOA developed by the US Army Environmental Center.

In Fort Belvoir's opinion, the project does not meet any of the criteria established in Appendix A to 36 CFR Part 800 for Advisory Council involvement in consultation. Therefore, after notification of the ACHP, we will request a meeting with your office to begin discussions regarding effects and mitigation.

If you have any questions, please contact Mr. Patrick McLaughlin, Chief, Environmental and Natural Resource Division, at (703) 806-4007, who will serve as Fort Belvoir's point of contact for this project. We look forward to working with you.

Sincerely,

Kevin W. Mahr
Lieutenant Colonel, U. S. Army
Director of Installation Support

Enclosures

DEPARTMENT OF THE ARMY
U.S. ARMY GARRISON, FORT BELVOIR
DIRECTORATE OF INSTALLATION SUPPORT
9430 JACKSON LOOP, SUITE 107
FORT BELVOIR, VIRGINIA 22060-5130

REPLY TO
ATTENTION OF

Environmental and Natural Resource Division

FEB 27 2003

Resident
Historic Housing Area
Fort Belvoir, VA 22060

Reference: Implementation of Residential Communities Initiative
US Army Garrison Fort Belvoir, Virginia

Dear Resident,

In accordance with the provisions of the National Historic Preservation Act (NHPA) of 1966 (as amended) we are inviting you/your organization to participate in a consultation process regarding resolution of adverse effects to resources listed in- or eligible for listing in the National Register of Historic Places (NRHP). These resources may be potentially impacted by implementation of the Residential Communities Initiative (RCI) at Fort Belvoir, Virginia. We have notified the Virginia Department of Historic Resources (VDHR) of an adverse effect finding and have invited them to participate in the consultation in accordance with the NHPA and its implementing regulations codified in 36 CFR Part 800. Once VDHR has considered our invitation, the Advisory Council on Historic Preservation (ACHP) will also be invited to participate in the consultation.

National Register of Historic Places Criteria

For your information, the NRHP defines four criteria of historic significance under which buildings, structures, sites, objects, and districts over 50 years in age may be evaluated and determined eligible for listing in the NRHP. These four criteria are generally:

A. Resources associated with events and patterns of our history
B. Resources associated with the lives of significant persons
C. Resources with distinctive construction or architectural value
D. Resources with a potential to yield information about the past

If a building, structure, object, site or district possesses physical or associative characteristics that significantly relate it to a specific historic context and also possess sufficient historic integrity to be a good representative of its property type, it could be considered eligible for listing in the National Register.

Section 106 Process

Section 106 of the NHPA provides that federal agencies, such as the US Army, take into account the effects of their actions on any resource included in- or eligible for inclusion in the NRHP in the Area of Potential Effect (APE) established for the project. Implementing regulations for Section 106 were established by the ACHP and are featured on the ACHP website at www.achp.gov. These regulations provide specific criteria for identifying historic properties within the APE,

identifying and assessing the effects of federal undertakings on historic properties, notifying consulting parties, and crafting mutually agreeable methods to mitigate adverse effects.

Identification of Historic Properties at Fort Belvoir

Multiple cultural resources studies have been undertaken at Fort Belvoir, resulting in the identification of historically significant resources, including the NRHP-eligible and Virginia Landmark-listed Fort Belvoir Historic District, the US Army Package Power Reactor, the Camp A. A. Humphreys Pump Station and Filter Building and the Thermo-Con House.

The Fort Belvoir Historic District encompasses residential and non-residential properties. The majority of buildings within the district were constructed between 1920 and 1940. All historic family housing at Belvoir, Gerber, and Park Villages, and a portion of Jadwin Village, is listed as contributing to the Fort Belvoir Historic District. Attachment A shows the location of the historic district as well as housing areas as described in "Description of the Undertaking," below.

Two additional historic housing areas are in the determination of eligibility process in accordance with Section 110 (16 U.S.C. 470h-2(a)) of the NHPA. For the purposes of this consultation, we are identifying these properties as potentially eligible and as potential contributing resources to the Fort Belvoir Historic District. These areas include housing at Bossell and Jadwin Villages.

In 1992, *Historic Components Guidebooks* governing the treatment of historic houses at Fort Belvoir were prepared for Belvoir Village and Gerber Village. In 2001, an *Integrated Cultural Resources Management Plan* was prepared to assist the installation in its stewardship of cultural and historic resources within its boundaries.

Furthermore, archaeological resources at Fort Belvoir have been investigated for over 70 years, resulting in the identification of over 300 archaeological sites. The Belvoir Manor Ruins and Fairfax Gravesites are listed on the NRHP. In 1994, VDHR confirmed that Fort Belvoir had satisfactorily completed archaeological identification studies for the installation.

Description of the Undertaking

The purpose of the RCI program is to privatize 763 current housing resources (2,070 Army Family Housing (AFH) units, eleven garages) at Fort Belvoir. Detailed information about the Fort Belvoir RCI program can be found at www.belvoir.army.mil.

One hundred seventy six NRHP-eligible resources are included in the RCI project area, as are 35 residential resources currently under review by the VDHR for determination of eligibility.

Furthermore, adverse effects to 410 Cold War-era Capehart-Wherry Era housing buildings (1370 AFH units) included in the RCI program at Fort Belvoir are covered under the "Program Comment for Capehart and Wherry Era Family Housing and Associated Structures and Landscape Features (1949-62)," recently adopted by the ACHP and are not the subject of this consultation.

The remaining 142 housing buildings (444 AFH units) on Fort Belvoir were constructed in 1980-1981 and do not possess any unique significance to justify consideration for eligibility for properties

not yet 50 years of age. These units are also not the subject of this consultation.

Seventeen archaeological sites are located in the Fort Belvoir RCI project area. Of these, two have been determined eligible, ten potentially eligible, and five not eligible for listing in the National Register. Archaeological sites will be avoided or mitigated.

The Army will lease the land on which the existing houses are located and land to be used as "swing space" (an area to construct replacement homes while others are demolished) to Clark Pinnacle. In exchange, Clark-Pinnacle will provide for replacement construction, renovation or rehabilitation of the housing and community amenities, as well as long-term operation, management, maintenance and rehabilitation of this inventory for a 50-year lease term with a 25-year renewal clause.

It is anticipated that Clark-Pinnacle will rehabilitate 148 of 176 resources currently identified as National Register-eligible conveyed to them in the privatization process, and five brick tower homes built in 1939 in Jadwin Village currently under review for determination of eligibility by the VDHR.

We have proposed demolition of most, if not all, of the remaining resources recently determined eligible for listing and those currently under review by the VDHR for a determination of eligibility. These resources are expected to be replaced with modern housing. These resources include the following:

14 Wood housing units built in 1920-21 in Jadwin Village
14 Wood housing units built in 1920-21 in Pearl Village
30 Duplex brick buildings built in 1947-48 in Bossell Village

Fort Belvoir is currently exploring a variety of alternatives to mitigate the proposed demolition.

Level and Nature of Federal Involvement

The Fiscal Year 1996 National Defense Authorization Act (Public Law 104-106) as codified in 10 U.S.C. 2871 et seq. includes provisions collectively known as the Military Housing Privatization Initiative, which provides the Services with alternative authorities for construction and improvement of military housing. Under these authorities, the Services can leverage appropriated housing construction funds and government-owned assets to obtain private capital in an effort to improve the quality of life for soldiers and their families.

Area of Potential Effect (APE)

The proposed APE for architectural and cultural landscape resources for this project coincides with five family housing neighborhoods on Fort Belvoir, including Belvoir, Gerber, Bossell, Park and Jadwin Villages. Capehart-Wherry units covered under the Program Comment, as well as modern units, are not within the APE.

The APE for archaeological resources is defined as all potential RCI project areas on the installation. Due to the sensitive nature of archaeological sites, location information is not provided in this letter. Specific questions or concerns about archaeological sites can be directed to Mr. Patrick McLaughlin, Chief, Environmental and Natural Resource Division on Fort Belvoir, at the contact information below.

Potential Effects on Historic Properties

In accordance with 36 CFR Part 800, Protection of Historic Properties, conveyance of (potentially-) eligible historic resources will have an adverse effect on the Fort Belvoir Historic District. Additionally, any demolition of (potentially-)eligible historic resources will have an adverse effect on the Fort Belvoir Historic District.

Fort Belvoir proposes to mitigate the adverse effects by drafting an agreement document between (at a minimum) Fort Belvoir and VDHR. This agreement document will be drafted in accordance with 36 CFR 800.

Interested Parties Meetings

Fort Belvoir will hold two meetings to discuss the contents of this letter and to solicit input from interested parties and stakeholders. The first meeting will be held from 1:00 to 3:00 PM on Wednesday, March 12th, 2003, in the main conference room at the South County Center, 8250 Richmond Highway, Alexandria, Virginia in Fairfax County. The second meeting will take place during the first week of April (the date, time, and place will be determined and provided to you at the first meeting). This letter serves as a formal invitation to the first meeting.

The goal of the meetings is to allow you to voice your comments concerning this action. We hope to involve you or those members of your organization that work with the management of cultural resources on a daily basis. This "working" level approach is intended to allow all parties and stakeholders to effectively submit and solicit input concerning the RCI project. Please visit the Fairfax County web site (www.fairfaxcounty.gov) or call (703) 704-7080 for information on and directions to the South County Center.

Your attendance and cooperation is appreciated. Please reply with your intention to participate in this meeting as an interested party no later than March 10, 2003 via email to environmental@belvoir.army.mil or via phone at (703) 806-4007, or fax to (703) 806-0622.

In lieu of attendance at the meetings, you may also submit written comments via email to the address above, via fax to the number above, or via mail to:

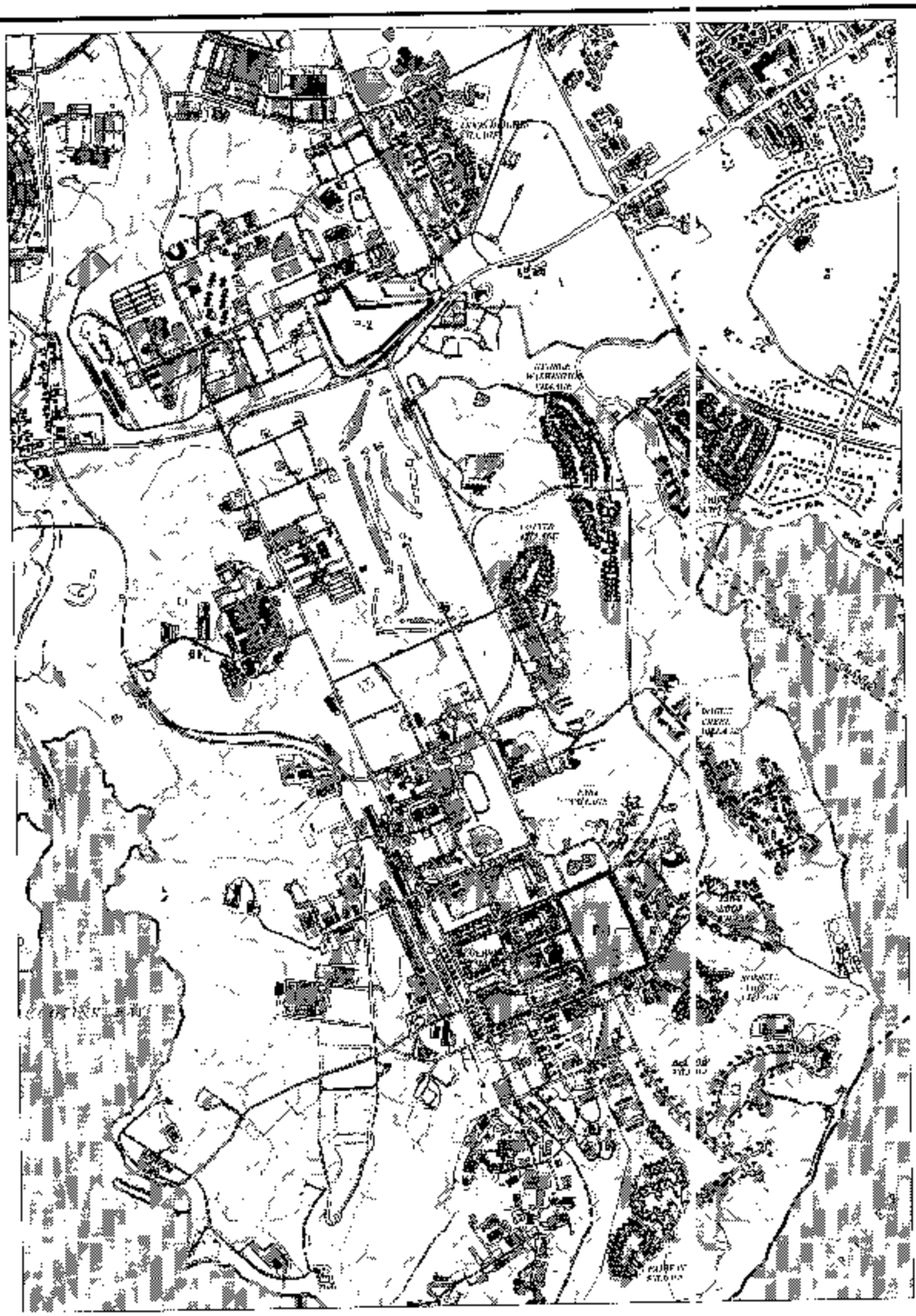
Environmental and Natural Resource Division
US Army Garrison Fort Belvoir
9430 Jackson Loop Road, Suite 107
Fort Belvoir, VA 22060-5130

If you have any questions or comments, please contact Mr. Patrick McLaughlin, Chief, Environmental and Natural Resource Division at (703) 806-4007. Mr. McLaughlin will serve as Fort Belvoir's point of contact for this project. We look forward to working with you

Sincerely,

Kevin M. Pate
Lieutenant Colonel, U. S. Army
Director of Installation Support

Enclosure



LEGEND

RCI PROJECT AREA &
HISTORIC RESOURCES
21 FEB, 2003 EDITION
FORT BELVOIR, VIRGINIA

COMMONWEALTH of VIRGINIA

Department of Historic Resources

W. Taylor Murphy, Jr.
Secretary of Natural Resources

2801 Kensington Avenue, Richmond, Virginia 23221

Kathleen S. Kilpatrick
Director

Tel: (804) 367-2323
Fax: (804) 367-2391
TDD: (804) 367-2386
www.dhr.state.va.us

February 25, 2003

LTC Kevin W. Tate
Director of Installation Support
Department of the Army
U.S. Army Garrison, Fort Belvoir
Directorate of Installation Support
9430 Jackson Loop, Suite 107
Fort Belvoir, Virginia 22060-5130

Re: Implementation of Residential Communities Initiative (RCI)
US Army Garrison Fort Belvoir
Fairfax County, Virginia
DHR File No. 2003-0021

Dear Colonel Tate:

We have received your request for our review and comment regarding the above referenced project. It is our understanding that the Department of the Army proposes to implement the Residential Communities Initiative (RCI) at Fort Belvoir, Virginia. The purpose of the RCI program is to privatize the on-post housing at Fort Belvoir and to construct additional housing units to meet the needs of soldiers and their families. Due to the nature of the project, the Army anticipates that the undertaking will have an adverse effect on the Fort Belvoir Historic District, a resource listed in the National Register of Historic Places.

Although we concur that there will be an effect to the historic resource, it is premature to conclude that that effect will be adverse. On 14 February 2003, Kathleen Kilpatrick, DHR Director, and two members of her staff, Ethel Eaton and Marc Holma, met with Colonel Williams, Fort Belvoir garrison commander, Maury Cralle, Director of Housing and Project Manager for the RCI, and Caroline Fisher, Project Manager RCI, to discuss the undertaking. At that meeting, the group determined that development of a Programmatic Agreement (PA) is appropriate for this undertaking due to its scope and potential to effect historic resources. The group decided to meet again at Fort Belvoir to further discuss the development of a PA and to give those who are not familiar with the resources at Fort Belvoir an opportunity to view them. A date of 25 February was set, however, DHR later requested that the Army reschedule the meeting to 6 March.

We look forward to working with the Army regarding the RCI project. If you have any questions about the Section 106 review process or our comments, please call me at (804) 367-2323, Ext. 114.

Sincerely,

Marc Holma, Architectural Historian
Office of Review and Compliance

To – DIS-ENV
– DPTMS – Historia
CF: CP
file – Friends

Alexandria Friends Meeting
Religious Society of Friends
8990 Woodlawn Road
Fort Belvoir, VA 22060

7 March

5 March 2003

Maury Cralle
Project Manager, Residential Communities Initiative
US Army Garrison, Fort Belvoir
9910 Tracy Loop, Building 766
Fort Belvoir, VA 22060-5443

Dear Mr. Cralle,

On behalf of the Alexandria Monthly Meeting of the Religious Society of Friends (Meeting), I would like to express my appreciation for the opportunities you have provided for information sharing and discussion concerning the potential effects of the Fort Belvoir Residential Communities Initiative (RCI) on our historic meetinghouse property and our worship community. We are pleased to hear that some of the urgency to move forward quickly may have eased, and we look forward to continuing our dialogue with you and with the other affected neighbors as Fort Belvoir's plans proceed.

As you know, the Meeting has formed an Ad Hoc Committee to facilitate communication and to help manage our ongoing participation in this process. Ad Hoc Committee members are Warren Treuer, Linda Spencer, David Sa'adah, Judy Riggin, and Martha Catlin. Decisions concerning the Meeting's position on any matter will, however, be made by the Meeting as a whole through worshipful Quaker process and will be communicated to Fort Belvoir in writing, as needed, by the Clerk, on behalf of the Meeting.

You have graciously asked our views on how the RCI project could be designed to ensure that our needs and concerns are addressed, and we have begun that dialogue within the Meeting community. At this stage, we feel that the most important need is for information regarding not only the RCI project but also the historical relationship between Fort Belvoir and the Meeting.

We believe this information will enrich our understanding of those periods of transition and also help us come together as a Meeting to form a response to your request for our views regarding our future. In addition, we hope any additional research we conduct will be of value to you in your RCI planning process. Recognizing that Fort Belvoir may hold records that could yield factual material (such as land records, archaeological data, historical maps, surveys, correspondence with former landowners, etc.) pertaining to this aspect of our shared history, we request your assistance in facilitating access to such records by the Ad Hoc Committee, whose

Action DPTMS Historian + DIS-ENV

members have agreed to begin the task of tracing land transfers of the descendants of the Woodlawn Quaker settlers.

Action DIS

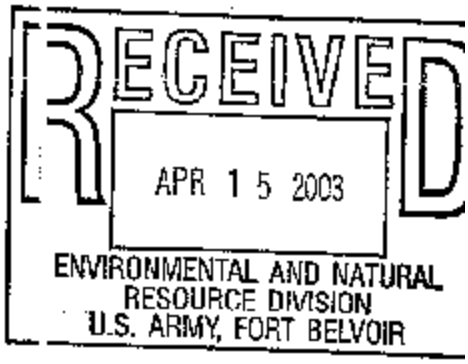
In addition to our informal coordination, which we consider to be quite constructive, you have indicated that Fort Belvoir's plans include initiation of the process of considering the RCI program's effects to historic properties pursuant to Section 106 of the National Historic Preservation Act. We look forward to participating in Section 106 consultation and request that we be included as "consulting parties" as defined in the Section 106 regulations of the Advisory Council on Historic Preservation, "Protection of Historic Properties" (36 CFR Part 800).

Again, thank you for your courtesy and consideration.

Sincerely,

Warren L. Treuer, Clerk

NATIONAL TRUST
for HISTORIC PRESERVATION



April 14, 2003

Patrick McLaughlin
US Army Garrison Fort Belvoir
Fort Belvoir Environmental And Natural Resource Division
9430 Jackson Loop Road, Suite 107
Fort Belvoir, VA 22060-5130

RE: Implementation of Residential Communities Initiative (RCI)
and Master Plan Process
US Army Garrison Fort Belvoir, Virginia

Dear Mr. McLaughlin:

This letter will confirm that the National Trust for Historic Preservation would like to participate as a consulting party for purposes of Section 106 of the National Historic Preservation Act (NHPA) with respect to the implementation of the Residential Communities Initiative (RCI) at Fort Belvoir. We understand that the Army plans to satisfy its Section 106 responsibilities through the development of a Programmatic Agreement for the RCI development.

In addition, we would like to participate as a consulting party with respect to the master planning process that has been initiated for Fort Belvoir. We understand that the Army will likely be using the NEPA documentation for the master plan to satisfy Section 106 requirements. Pursuant to 36 C.F.R. §§ 800.2(c)(5) and 800.3(f)(3), the National Trust requests an opportunity to participate formally as a consulting party with respect to this project.

We appreciate your taking the time to meet with us and other interested parties at Woodlawn on April 3, 2003 to discuss the RCI plans for the Lewis Heights neighborhood, immediately adjacent to Woodlawn, and to provide us with background information on the broader scope of the RCI program at Fort Belvoir. (In addition, as you know, the National Trust also participated in the March 12th public meeting on the RCI plans.)

Interests of the National Trust

The National Trust for Historic Preservation was chartered by Congress in 1949 as a private nonprofit organization for the purpose of furthering the historic preservation policies of the United States and facilitating public participation in the preservation of our nation's heritage. 16 U.S.C. § 468. With the support of our 250,000 members nationwide, including nearly 18,000 members in Virginia, the National Trust works to protect significant historic sites and to advocate historic preservation as a fundamental value in programs and policies at all levels of

1785 MASSACHUSETTS AVENUE, NW · WASHINGTON, DC 20036
202.588.6000 · FAX: 202.588.6038 · TTY: 202.588.6200 · WWW.NATIONALTRUST.ORG

government. The Trust has seven regional offices around the country, including a Southern Field Office in Washington, DC, which is specifically responsive to preservation issues in Virginia.

The Trust has a particular interest in enforcing agency compliance with the National Historic Preservation Act, since the Chairman of the Trust has been designated by Congress as a member of the federal Advisory Council on Historic Preservation. *Id.* § 470i(a)(8). In addition, the Trust has a history of involvement in issues regarding federal agency stewardship of historic properties, including specific experience with Department of Defense agencies. We think the National Trust could play a constructive role in the consultation process for these undertakings by bringing our national perspective to bear on the RCI implementation and the planning process at Fort Belvoir.

Thus, the National Trust's interest in participating in the review process for these undertakings is based on our dual role both as a national policy advocate and as a neighboring property owner. Fort Belvoir is immediately adjacent to Woodlawn, which is one of the National Trust's 21 Historic Sites. In our roles as neighbors, Woodlawn and Fort Belvoir have been working together for more than a year in consultation with the Virginia Department of Transportation regarding the proposed widening of Route 1, which cuts through both properties.

At the same time, because the RCI is a national program with historic resource implications for other Army facilities, the National Trust has a policy interest in these undertakings that extends beyond Fort Belvoir.

As the Section 106 process gets underway for both undertakings, please send any notices of meetings and documents for review and comment to both of the following addresses:

Ross Randall, Director
Woodlawn
P.O. Box 37
Mt. Vernon, VA 22121
T: 703-780-4000 x.26
F: 703-780-8509
ross_randall@nthp.org

Robert Nieweg, Director
Southern Field Office
National Trust for Historic Preservation
1785 Massachusetts Ave. NW
Washington, DC 20036
T: 202-588-6107
F: 202-588-6223
robert_nieweg@nthp.org

Meanwhile, for the RCI implementation, we would appreciate receiving any additional information that has been developed for the project, to help us understand some of the preliminary decisions that have been made. For example, we note from the hand-out that the Army is proposing to demolish 58 historic buildings at Fort Belvoir to implement the RCI. We would like to review the studies that may have led to this decision, such as condition assessments or feasibility studies for rehabilitation.

We appreciate your consideration of the National Trust's views, and we look forward to working with you to address the issues presented by this project as the environmental and historic preservation review process goes forward.

Sincerely,

Elizabeth S. Merritt
Deputy General Counsel

Robert Nieweg, Director
Southern Field Office

cc: Brian M. Lione, Fort Belvoir
Beth Hesler, Torti Gallas & Partners
Joe Jones, Fort Belvoir RCI
Cheri Thompson, Fort Belvoir RCI
Eleanor Krause, Architects Studio
Linda Cornish Blank, Fairfax County Government
Martha Catlin, Alexandria Friends Meeting at Woodlawn
Nancy R. James, Alexandria Friends Meeting at Woodlawn
Tom McCulloch, Advisory Council on Historic Preservation
Ross Randall, Director, Woodlawn

DEPARTMENT OF THE ARMY
U. S. ARMY GARRISON, FORT BELVOIR
DIRECTORATE OF PUBLIC WORKS AND LOGISTICS
9430 JACKSON LOOP, SUITE 103
FORT BELVOIR, VIRGINIA 22060-5116

REPLY TO
ATTENTION OF

Environmental and
Natural Resource Division

APR 15 2003

Ross Randall
Director
Woodlawn Plantation
9000 Richmond Highway
Alexandria, VA 22309

Mr. Randall:

On April 3, 2003, your organization hosted a meeting with representatives from Fort Belvoir to discuss the Residential Communities Initiative (RCI) and its potential effects on historic resources on and off the installation. During that meeting, you requested a map of archaeological sites on the installation. Please find the map enclosed, entitled "Archaeological Sites and RCI Areas - 26MAR03 Edition."

Please note that archaeological site data is considered sensitive information by Fort Belvoir. As such, we ask that you not share this map with anyone in your organization who does not have direct involvement in the RCI process. Additionally, we provide this map to you with the understanding that it will not be reproduced in any way without consultation and approval by a government representative of the Environmental and Natural Resource Division (ENRD).

Thank you for your interest and proactive involvement in the RCI process. If you have any further questions, please contact Patrick McLaughlin, Chief of ENRD, at (703) 806-3193. We look forward to continuing our positive working relationship with you.

Sincerely,

Kevin W. Tate
Lieutenant Colonel, U. S. Army
Director of Public Works
and Logistics

Enclosure

DEPARTMENT OF THE ARMY
U. S. ARMY GARRISON, FORT BELVOIR
DIRECTORATE OF PUBLIC WORKS AND LOGISTICS
9430 JACKSON LOOP, SUITE 100
FORT BELVOIR, VIRGINIA 22060-5116

REPLY TO
ATTENTION OF

Environmental and
Natural Resource Division

APR 15 2003

Elizabeth S. Merritt
Deputy General Council
Law Department,
National Trust for Historic Preservation
1785 Massachusetts Avenue, NW
Washington DC 20036

Ms. Merritt:

In a letter to this office dated April 14, 2003, you requested that the National Trust for Historic Preservation be considered a consulting party in the Section 106 consultation process for the Residential Communities Initiative (RCI) on Fort Belvoir.

In accordance with 36 CFR 800.2, Fort Belvoir has determined that your organization meets the criteria required to be considered a "consulting party." This letter serves as official notification of your consulting party status.

If you have any questions concerning this action, please contact Patrick McLaughlin, Chief of the Environmental and Natural Resource Division, at (703) 806-3193. Thank you for your interest in the RCI process and historic resources on Fort Belvoir. We look forward to working with you.

Sincerely,

Kevin W. Tate
Lieutenant Colonel, U. S. Army
Director of Public Works
and Logistics

DEPARTMENT OF THE ARMY
U. S. ARMY GARRISON, FORT BELVOIR
DIRECTORATE OF PUBLIC WORKS AND LOGISTICS
9430 JACKSON LOOP, SUITE 100
FORT BELVOIR, VIRGINIA 22060-5116

REPLY TO
ATTENTION OF

APR 15 2003

Environmental and
Natural Resource Division

Linda Cornish Blank
County Historic Preservation Planner
County of Fairfax
Department of Planning and Zoning
12055 Government Center Parkway, Suite 730
Fairfax, Virginia 22035

Ms. Blank:

At a public meeting on March 12, 2003, you requested that the County of Fairfax be considered a consulting party in the Section 106 process for the Residential Communities Initiative (RCI) on Fort Belvoir.

In accordance with 36 CFR 800.2, Fort Belvoir has determined that your organization meets the criteria required to be considered a "consulting party." This letter serves as official notification of your consulting party status.

If you have any questions concerning this action, please contact Patrick McLaughlin, Chief of the Environmental and Natural Resource Division, at (703) 806-1007. Thank you for your interest in the RCI process and historic resources on Fort Belvoir. We look forward to working with you.

Sincerely,

Kevin W. Tate
Lieutenant Colonel, U. S. Army
Director of Public Works
and Logistics

DEPARTMENT OF THE ARMY
U. S. ARMY GARRISON, FORT BELVOIR
DIRECTORATE OF PUBLIC WORKS AND LOGISTICS
9430 JACKSON LOOP, SUITE 100
FORT BELVOIR, VIRGINIA 22060-5116

REPLY TO
ATTENTION OF

Environmental and
Natural Resource Division

APR 15 2003

Warren L. Treuer
Clerk
Alexandria Friends Meeting
Religious Society of Friends
8990 Woodlawn Road
Fort Belvoir, VA 22060

Mr. Treuer:

In a letter dated March 5, 2003, you requested that the Alexandria Friends Meeting, Religious Society of Friends be considered a consulting party in the Section 106 process for the Residential Communities Initiative (RCI) on Fort Belvoir.

In accordance with 36 CFR 800.2, Fort Belvoir has determined that your organization meets the criteria required to be considered a "consulting party." This letter serves as official notification of your consulting party status.

If you have any questions concerning this action, please contact Patrick McLaughlin, Chief of the Environmental and Natural Resource Division, at (703) 806-4007. Thank you for your interest in the RCI process and historic resources on Fort Belvoir. We look forward to working with you.

Sincerely,

Kevin W. Tate
Lieutenant Colonel, U. S. Army
Director of Public Works
and Logistics

DEPARTMENT OF THE ARMY
U. S. ARMY GARRISON, FORT BELVOIR
DIRECTORATE OF PUBLIC WORKS AND LOGISTICS
9430 JACKSON LOOP, SUITE 100
FORT BELVOIR, VIRGINIA 22060-5116

REPLY TO
ATTENTION OF

Environmental and Natural
Resource Division

APR 18 2003

Don L. Klima
Director
Office of Federal Agency Programs, Eastern Office
Advisory Council on Historic Preservation
Old Post Office Building
1100 Pennsylvania Avenue, NW, Suite 803
Washington, DC 20004

RE: Implementation of Residential Communities Initiative
US Army Garrison Fort Belvoir, Virginia

Dear Mr. Klima:

In accordance with the provisions of 36 CFR Part 800.6(a)(1) and 36 CFR Part 800 Appendix A, we are requesting your participation in the resolution of adverse effects related to the implementation of the United States Army Residential Communities Initiative (RCI) at Fort Belvoir, Virginia. On February 6, 2003, we notified the Virginia Department of Historic Resources (VDHR) of our finding of adverse effects to historic resources (Attachment A). During a meeting with Fort Belvoir on March 6, 2003, VDHR verbally concurred with our finding and suggested that we invite you to participate in the consultation process.

Description of the Undertaking

The purpose of the RCI program is to privatize 765 current residential resources (2,070 Army Family Housing [AFH] units, eleven garages) at Fort Belvoir. Detailed information about the Fort Belvoir RCI program can be found at www.belvoir.army.mil, and in the body of our letter to VDHR, dated February 6, 2003 (Attachment A).

Briefly stated, 176 residential resources eligible for listing in the National Register of Historic Places (NRHP) are included in the RCI project area, as are 35 residential resources currently under review by the VDHR for determination of eligibility. These 211 (potentially-) eligible resources, in addition to seventeen archaeological sites, are the subject of our consultation.

Area of Potential Effect (APE)

The proposed APE for architectural and cultural landscape resources for this project coincides with five family housing neighborhoods on Fort Belvoir, including Belvoir, Gerber, Rossell, Park and Jadwin Villages. Capehart-Wherry units covered under the Program Comment, as well as modern units, are not within the APE.

The APE for archaeological resources is defined as all potential RCI project areas on the installation. Please note that earlier plans for the RCI project area (as referenced in our initial letter to VDHR on February 6, 2003) included 49 archaeological resources in the APE. The current revision to the RCI APE is accurately reflected in the map attachments to this letter.

The location of the RCI project area in relation to the historic housing areas and archaeological resources can be found in attachments (to this letter) B and C, respectively. Please note that attachments showing an outdated project area as referenced in our letter to VDHR on February 6, 2003 are not included.

Public and Stakeholder Involvement

A public scoping meeting was held on January 16, 2003 at Walt Whitman Middle School in Alexandria, Virginia to solicit public comments on the Environmental Assessment for the Fort Belvoir RCI project in accordance with the National Environmental Policy Act. A poster station explaining the Section 106 process was included at the meeting for those wishing to learn more about Fort Belvoir historic resources and Section 106 (Attachment D). Comments concerning the NEPA and Section 106 actions were solicited at the meeting, and comment sheets inviting the public to send in written input were provided.

On February 27, 2003, Fort Belvoir sent an invitation to over 65 local organizations and interested members of the public, in addition to over 225 residents of every historic home on the installation (sample letter included at Attachment E).

On Thursday, March 6, 2003, Fort Belvoir hosted Ms. Kathleen Kilpatrick, Virginia State Historic Preservation Officer, and staff members from the VDHR. During the visit, the SHPO and staff were given a tour of the historic resources and a briefing concerning Fort Belvoir's proposed action (Attachment F).

The first public meeting specifically addressing the Section 106 process, held Wednesday, March 12th, 2003, at the South County Center in Alexandria, Virginia, included a briefing that addressed historic resources and the RCI process (Attachment G). Input and comments on the process were solicited from attendees.

Woodlawn Plantation, Alexandria Friends Meeting - Religious Society of Friends, and the Fairfax County Certified Local Government Program have requested "consulting party" status in accordance with 36 CFR 800.2(c). Fort Belvoir is establishing connections to these organizations and considering their involvement.

A second public meeting will be held in May to further discuss the RCI project, the Section 106 process, and the adverse effects to historic resources on the installation.

All comments received from the NEPA scoping meeting, the two public meetings, and focus meetings with consulting parties will be considered in drafting the Programmatic Agreement.

Consultation

By copy of this letter we are notifying you of our determination that the sale and subsequent treatment of historic

family housing units at Fort Belvoir, lease of ground upon which they sit and the potential impact of new construction on archaeological sites will have an adverse effect on properties eligible for listing on the NRHP. In Fort Belvoir's opinion, the project meets the criteria established in 36 CFR Part 800 Appendix A - (c)(2), as the complexity of the Fort Belvoir RCI program and the subsequent Programmatic Agreement will continue to set precedent for future RCI projects across the nation.

If we do not hear from you within 15 days of receipt of notification, we will continue consultation with the VDHR regarding effects and mitigation to be included in a Programmatic Agreement.

If you have any questions or comments concerning this action, please contact Mr. Patrick McLaughlin, Chief, Environmental and Natural Resource Division at (703) 806-3193. Mr. McLaughlin will serve as Fort Belvoir's point of contact for this project. We look forward to working with you.

Sincerely,

Kevin W. Tate
Lieutenant Colonel, U. S. Army
Director of Public Works
and Logistics

Enclosures

DEPARTMENT OF THE ARMY
U. S. ARMY GARRISON, FORT BELVOIR
DIRECTORATE OF PUBLIC WORKS AND LOGISTICS
9430 JACKSON LOOP, SUITE 100
FORT BELVOIR, VIRGINIA 22060-5116

REPLY TO
ATTENTION OF

APR 18 2003

Environmental and
Natural Resource Division

Resident
Historic Housing Area
Fort Belvoir, VA 22060

Dear Historic Housing Resident:

On March 12, 2003, Fort Belvoir held a meeting to explain the Residential Communities Initiative (RCI) process on the installation and its potential to affect resources listed in, or eligible for listing in, the National Register of Historic Places (NRHP). The meeting was also designed to solicit input from the public and consulting parties about the process and its potential effects.

The next meeting will be held from 7:00 to 9:00 PM on Tuesday, May 13th, 2003, in the main conference room at the South County Center, 8350 Richmond Highway, Alexandria, Virginia in Fairfax County. Information on the South County Center (including directions) can be found at http://www.co.fairfax.va.us/maps/locatesouthcocenter.htm or by calling (703) 704- 080. This letter serves as a formal invitation to the second meeting.

Detailed information concerning the RCI project was included in the invitation to the first meeting, mailed on February 27, 2003. If you have recently been added to our mailing list, a copy of the letter is enclosed here for your reference. If you did not receive the first invitation, and no copy is enclosed, please call (703) 806-3759 and request that a copy of February 27, 2003 letter be sent to you.

Since the first meeting in February, we have continued to develop and refine our plans for historic resources on the installation. At the May 13 meeting, we will present conceptual designs for infill housing in- and adjacent to the historic district, proposed plans to rehabilitate the interior and exterior of historic homes, and proposed plans to construct garages in Belvoir, Gerber, Jadwin, and Park Villages.

Specific details concerning the proposed demolition of 58 historic buildings in Jadwin, Park, and Rossell Villages will also be presented at the May 13 meeting. Descriptions of

proposed methods to mitigate the adverse effects of the demolition to the historic resources will be available for your review and comment.

Your attendance and cooperation is appreciated. Please reply with your intention to participate in this meeting no later than May 9, 2003 via email to environmental@be.belvoir.army.mil or via phone at (703) 806-4007, or fax to (703) 806-0622. Your comments concerning the RCI project and its effects to historic resources are welcome at any time using these methods of contact, or in person during the May 13 meeting. We request that all comments be received no later than May 30, 2003.

Thank you for your interest and proactive involvement in the RCI process. If you have any further questions, please contact Patrick McLaughlin, Chief of the Environmental and Natural Resource Division, at (703) 806-3193.

Sincerely,

Kevin W. Tate
Lieutenant Colonel, U. S. Army
Director of Public Works
and Logistics

MAY - 5 2003

Lieutenant Colonel Kevin W. Tate
Director of Public Works and Logistics
U.S. Army Garrison, Fort Belvoir
Directorate of Public Works and Logistics
9430 Jackson Loop, Suite 100
Fort Belvoir, VA 22060-5116

REF: Implementation of Residential Communities Initiative (RCI) at Fort Belvoir

Dear Lieutenant Colonel Tate:

We have reviewed the documentation that the U.S. Army has forwarded, along with your invitation to the ACHP to participate in the consultation to avoid, minimize, or mitigate adverse effects to historic properties caused by the referenced undertaking.

Our review of this material was to determine whether the ACHP should participate in the consultation leading to a Programmatic Agreement (PA) to address effects to historic properties. Under the ACHP's regulations (36 CFR Part 800.2(b)(1)), the ACHP can enter into the consultation process if necessary to "ensure that the purposes of section 106 and the [National Historic Preservation] act are met."

Fort Belvoir's plans are to privatize over 2000 Army Family Housing units and associated facilities. Many of these structures to be renovated or removed, and archaeological properties in the Area of Potential Effect, are considered eligible for inclusion in the National Register of Historic Places. Both Fort Belvoir and the Virginia State Historic Preservation Officer have agreed that the RCI will have adverse effects to some of these historic properties. Fort Belvoir also is implementing an extensive public outreach and stakeholder program to ensure that the wider community around the Fort have the opportunity to make their concerns known and to participate in the decision making.

In discussing this ongoing process with some of the participants it appears that this consultation is proceeding smoothly. Accordingly, we do not believe that our formal entry into the Section 106 process is necessary at this time. Thus, we will not be a consulting party to implement the RCI program at Fort Belvoir. However, should circumstances change and you determine that our participation is required, please notify us. We are also available to assist Fort Belvoir on an informal basis to ensure that historic properties receive due consideration as the RCI progresses.

Pursuant to the ACHP's regulations, you will need to file the final PA and related documentation at the conclusion of the consultation process. The filing of the PA with the ACHP is required in order for the U.S. Army to complete its compliance responsibilities under Section 106 of the National Historic Preservation Act.

Thank you for your cooperation. Should you have any questions, or wish to discuss this matter, please contact Dr. Tom McCulloch at (202) 606-8505, or by E-mail at tmcculloch@achp.gov.

Sincerely,

David L. Klima
Director
Office of Federal Agency Programs

DEPARTMENT OF THE ARMY
U. S. ARMY GARRISON, FORT BELVOIR
DIRECTORATE OF PUBLIC WORKS AND LOGISTICS
9430 JACKSON LOOP, SUITE 100
FORT BELVOIR, VIRGINIA 22060-5116

REPLY TO
ATTENTION OF

Environmental and
Natural Resource Division

MAY 5 2003

Marc Holma
Architectural Historian
Office of Review and Compliance
Department of Historic Resources
2801 Kensington Avenue
Richmond, VA 23221

Re: Determination of consulting parties for Residential Communities Initiative (RCI) Section 106 process
DHR File Number 2003-0021

Dear Mr. Holma:

This letter is to document that the following organizations have requested consulting party status for the RCI Section 106 process. They are the only organizations to have requested such status. In accordance with 36 CFR 800.2, Fort Belvoir has determined that these organizations meet the criteria to be considered consulting parties:

Alexandria Friends Meeting, Religious Society of Friends
Fairfax County Government
National Trust for Historic Preservation

Official notification of consulting party status was mailed to each of the organizations on April 18, 2003.

In addition, residents of Fort Belvoir historic housing were invited to attend a historic housing intake session on April 23, 2003, as additional consulting parties.

If you have any questions concerning this action, please contact Patrick McLaughlin, Chief of the Environmental and Natural Resource Division, at (703) 806-3193.

Sincerely,

Kevin W. Tate
Lieutenant Colonel, U. S. Army
Director of Public Works
and Logistics

MAY - 5 2003

Lieutenant Colonel Kevin W. Tate
Director of Public Works and Logistics
U.S. Army Garrison, Fort Belvoir
Directorate of Public Works and Logistics
9430 Jackson Loop, Suite 100
Fort Belvoir, VA 22060-5116

REF: Implementation of Residential Communities Initiative (RCI) at Fort Belvoir

Dear Lieutenant Colonel Tate:

We have reviewed the documentation that the U.S. Army has forwarded, along with your invitation to the ACHP to participate in the consultation to avoid, minimize, or mitigate adverse effects to historic properties caused by the referenced undertaking.

Our review of this material was to determine whether the ACHP should participate in the consultation leading to a Programmatic Agreement (PA) to address effects to historic properties. Under the ACHP's regulations (36 CFR Part 800.2(b)(1)), the ACHP can enter into the consultation process if necessary to "ensure that the purposes of section 106 and the [National Historic Preservation] act are met."

Fort Belvoir's plans are to privatize over 2000 Army Family Housing units and associated facilities. Many of these structures to be renovated or removed, and archaeological properties in the Area of Potential Effect, are considered eligible for inclusion in the National Register of Historic Places. Both Fort Belvoir and the Virginia State Historic Preservation Officer have agreed that the RCI will have adverse effects to some of these historic properties. Fort Belvoir also is implementing an extensive public outreach and stakeholder program to ensure that the wider community around the Fort have the opportunity to make their concerns known and to participate in the decision making.

In discussing this ongoing process with some of the participants it appears that this consultation is proceeding smoothly. Accordingly, we do not believe that our formal entry into the Section 106 process is necessary at this time. Thus, we will not be a consulting party to implement the RCI program at Fort Belvoir. However, should circumstances change and you determine that our participation is required, please notify us. We are also available to assist Fort Belvoir on an informal basis to ensure that historic properties receive due consideration as the RCI progresses.

Pursuant to the ACHP's regulations, you will need to file the final PA and related documentation at the conclusion of the consultation process. The filing of the PA with the ACHP is required in order for the U.S. Army to complete its compliance responsibilities under Section 106 of the National Historic Preservation Act.

Thank you for your cooperation. Should you have any questions, or wish to discuss this matter, please contact Dr. Tom McCulloch at (202) 606-8505, or by E-mail at tmcculloch@achp.gov.

Sincerely,

David L. Klima
Director
Office of Federal Agency Programs

DEPARTMENT OF THE ARMY
RESIDENTIAL COMMUNITIES INITIATIVE
HEADQUARTERS, U.S. ARMY GARRISON, FORT BELVOIR
9910 TRACY LOOP, BUILDING 766
FORT BELVOIR, VIRGINIA 22060-5843

September 3, 2002

Elizabeth Locklear
Virginia Department of Conservation and Recreation
Division of Natural Heritage
217 Governor Street, 3rd Floor
Richmond, Virginia 23219

Dear Ms. Locklear:

The Army is preparing an Environmental Assessment (EA) for the Residential Communities Initiative (RCI) at Fort Belvoir, Virginia. The Army proposes to convey the existing family housing units in 12 existing housing villages and to provide a 50-year land lease of the underlying land parcels (465 acres) and of an additional 43-acre development parcel, to a private-sector development entity. Over a number of years, the RCI project will revitalize or replace some existing housing units and construct additional housing units on these parcels.

The affected parcels on Fort Belvoir are identified on the enclosed maps. For context, I have also enclosed an area map. The EA will review the potential environmental effects of the proposed action, including potential threats to the continued existence of threatened and endangered species or the destruction or adverse modification of critical habitat.

We would like to solicit information from you regarding the known locations of rare, threatened, and endangered species at Fort Belvoir, especially those within or near the affected parcels (see the enclosed maps). In addition, we would value any comments you may have on the proposed action. We would greatly appreciate receiving the information within 30 days of your receipt of this letter.

I have included four enclosures for your viewing. They are: Figure 1-1, Installation Location; Figure 2-1, Site Map; Figure X, Proposed RCI Site; and, RCI Information Paper.

If you have any questions, I may be reached at 703-805-3018 or by fax at 703-805-3025. Thank you for your kind assistance.

Respectfully,

4 Enclosures

George L. Barbee
Program Manager

Copy Furnished w/o Enclosures:
Deputy Garrison Commander, U.S. Army Garrison, Fort Belvoir
Director for Installation Support, Environmental Management Office, Fort Belvoir
Public Affairs Office, U.S. Army Garrison, Fort Belvoir

DEPARTMENT OF THE ARMY
RESIDENTIAL COMMUNITIES INITIATIVE
HEADQUARTERS, U.S. ARMY GARRISON, FORT BELVOIR
9910 TRACY LOOP, BUILDING 766
FORT BELVOIR, VIRGINIA 22060-5843

September 3, 2002

Karen L. Mayne
United States Department of the Interior
Fish and Wildlife Service
Ecological Services
6669 Short Lane
Gloucester, VA 23061

Dear Ms. Mayne:

The Army is preparing an Environmental Assessment (EA) for the Residential Communities Initiative (RCI) at Fort Belvoir, Virginia. The Army proposes to convey the existing family housing units in 12 existing housing villages and to provide a 50-year land lease of the underlying land parcels (465 acres) and of an additional 43-acre development parcel, to a private-sector development entity. Over a number of years, the RCI project will revitalize or replace some existing housing units and construct additional housing units on these parcels.

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Respectfully,

4 Enclosures

George L. Barbee
Program Manager

Copy Furnished w/o Enclosures:
Deputy Garrison Commander, U.S. Army Garrison, Fort Belvoir
Director for Installation Support, Environmental Management Office, Fort Belvoir
Public Affairs Office, U.S. Army Garrison, Fort Belvoir

DEPARTMENT OF THE ARMY
RESIDENTIAL COMMUNITIES INITIATIVE
HEADQUARTERS, U.S. ARMY GARRISON, FORT BELVOIR
9910 TRACY LOOP, BUILDING 766
FORT BELVOIR, VIRGINIA 22060-5843

September 3, 2002

Karen Reay
Virginia Department of Game and Inland Fisheries
Environmental Services Section
P.O. Box 11104
Richmond, Virginia 23230

Dear Ms. Reay:

The Army is preparing an Environmental Assessment (EA) for the Residential Communities Initiative (RCI) at Fort Belvoir, Virginia. The Army proposes to convey the existing family housing units in 12 existing housing villages and to provide a 50-year land lease of the underlying land parcels (465 acres) and of an additional 43-acre development parcel, to a private-sector development entity. Over a number of years, the RCI project will revitalize or replace many existing housing units and add some new housing units on these parcels.

The affected parcels on Fort Belvoir are identified on the enclosed maps. For context, I have also enclosed an area map. The EA will review the potential environmental effects of the proposed action, including potential threats to the continued existence of threatened and endangered species or the destruction or adverse modification of critical habitat.

We would like to solicit information from you regarding the known locations of rare, threatened, and endangered species at Fort Belvoir, especially those within or near the affected parcels (see the enclosed maps). In addition, we would value any comments you may have on the proposed action. We would greatly appreciate receiving the information within 30 days of your receipt of this letter.

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If you have any questions, I may be reached at 703-805-3018 or by fax at 703-805-3025. Thank you for your kind assistance.

Respectfully,

4 Enclosures

George L. Barbee
Program Manager

Copy Furnished w/o Enclosures:
Deputy Garrison Commander, U.S. Army Garrison, Fort Belvoir
Director for Installation Support, Environmental Management Office, Fort Belvoir
Public Affairs Office, U.S. Army Garrison, Fort Belvoir

FORT BELVOIR
RESIDENTIAL COMMUNITIES INITIATIVE

INFORMATION PAPER

The quality of life of military members and their families as well as military retention has long been on the Army's forefront, with military family housing as a primary priority. Today, military families needs are quite different than when military family housing was built four decades ago. Suitable, convenient, safe, and affordable family housing is not available in the local real estate market at rates that are within the financial means of many enlisted families. Additionally, due to ever decreasing Congressional funding levels, the traditional military construction program is unable to keep pace with the needed maintenance and repair and the requirements for construction of new or additional military family housing.

The Army's intent is to use legislative authorities contained in the Defense Authorization Act known as the Military Housing Privatization Initiative signed into law in 1996. This legislation provides alternative solutions for the Military Services to improve military family housing. The legislation is intended to influence the way military families live in the future by offering safe, affordable, convenient, attractive, and quality residential communities similar to those found in the local community.

Under the Army's RCI program, Fort Belvoir is looking for a long-term relationship with a partner to finance, design, construct, manage, operate, maintain, and repair its military family housing inventory over a fifty-year period. In exchange for this business opportunity, the developer partner will receive the military member's basic allowance for housing as rent. The RCI focus is on quality residential communities rather than quantity.

We expect to kick-off the partnership with our selected developer partner by the middle of September 2002. Following the selection, we estimate the joint collaboration phase and the formulation of the Fort Belvoir Community Development and Management Plan (CDMP) to take one year before formal implementation. The CDMP contains the business and financial plans and sets forth the terms and conditions of the partnership's long-term relationship with the Army. The CDMP will require approvals from the Department of the Army, Defense Department, Office of Management and Budget and Congress before transitioning the property from the Government to the developer partner.

Recognizing the complexity and breath of issues and concerns that arise in planning and executing projects of this magnitude and scope, a range of topics proposed in the CDMP will be fully coordinated with residents, various civic and community leaders, county and state officials, and other interested stakeholders.

We anticipate replacing the entire existing military family housing inventory with the exception of those homes that are considered to be historic. Further, we anticipate the construction of several neighborhood centers to accommodate family gatherings and activities along with the reshaping of the housing areas into residential communities similar to those found in the local community.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ecological Services
6669 Short Lane
Gloucester, VA 23061

October 03, 2002

Mr. George Barbee
Department of the Army
9910 Tracy Loop, Building 766
Fort Belvoir, Virginia 22060-5843

Re: Residential Communities Initiative,
2690, Fairfax County, Virginia

Dear Mr. Barbee:

The U.S. Fish and Wildlife Service (Service) has received your request for information on federally listed or proposed endangered or threatened species and designated critical habitat for the referenced project. This letter is submitted in accordance with provisions of the Endangered Species Act (ESA) of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.).

Your client, the U.S. Army, proposes to convey 12 existing housing villages and to provide a 50-year land lease of 508 acres of underlying land parcels currently located inside of Fort Belvoir to a private-sector development entity. During the time the land is leased, some of the existing housing units will be revitalized or replaced and new additional housing will be constructed. Occurrences of small whorled pogonia (*Isotria medeoloides*), Federally listed threatened, have been documented in an adjacent county, and the Service believes appropriate habitat may exist at the site. Appropriate habitat for this orchid is ordinary-looking, third-growth upland forests with an open understory on terrain that is almost level or gently to moderately sloping, but it has been found on steep slopes. Although the pogonia may be found more often on slopes with northerly or easterly exposures, all aspects with appropriate habitat may contain the pogonia. Small whorled pogonia sites can be generally characterized by their proximity to canopy openings, the presence of dead standing trunks, little herbaceous ground cover, and wood litter on the ground. The Service recommends a survey within appropriate habitat at the project site. Surveys should be conducted between June 1 and July 20, of any given year. The Service also recommends that you consider survey needs of and potential effects to state listed endangered and threatened species. Outside of these months, a site visit by a qualified individual can determine if appropriate habitat exists at the project site.

FILE 10 Oct 02

FAXED 10 Oct 02

The attached list contains individuals who are qualified to assess habitat and conduct surveys for the small whorled pogonia. This list may not include all individuals qualified or authorized to survey for this species. If a surveyor is selected who is not on the pre-approved surveyor list, the surveyor's qualifications and proposed survey design should be submitted to this office for eview at least 30 days prior to work. Please send copies of all survey results to this office or

inform this office if a survey will not be conducted. If the survey determines that any rare species are present, please contact this office to allow us the opportunity to work with the Army to ensure that this project avoids or minimizes adverse effects to rare species and their habitats.

If a qualified surveyor determines that no small whorled pogonia exists on the project site, the Service believes that the project would not likely adversely affect listed species and that further consultation pursuant to section 7 of the ESA is not necessary.

If you have any questions or need further assistance concerning this project, contact Ms. Jolie Harrison at (804) 693-6694, extension 208.

Sincerely,

Karen L. Mayne

Karen L. Mayne
Supervisor
Virginia Field Office

Enclosures

Small Whorled Pogonia

Isotria medeoloides

© D.D. Tyler

Description - The small whorled pogonia is a herbaceous perennial orchid. It has a widely scattered distribution in the eastern United States along the Atlantic coast from Maine to Georgia with outlying occurrences in the midwest and Canada. This species has pale green, elliptical leaves, usually five or six, that grow in a single whorl at the top of a hairless, grayish-green stem. The one or two flowers per plant are yellowish-green, unscented, and form in the center of the whorl.

Life History - In Virginia, the small whorled pogonia is found in ordinary looking third-growth upland forests with an open understory and a closed canopy where the topography is typically moderately sloping or almost level. The plants are usually associated with decaying vegetative matter such as fallen trunks and limbs, leaf litter, bark, and tree roots. The pogonia is found in soils that are acidic sandy loams with low nutrient content. The flowers appear in late April to mid-May. The small whorled pogonia reproduces primarily through self-pollination and occasionally vegetatively. It is often confused with the Indian cucumber-root (*Medeola virginiana*) and the large whorled pogonia (*Isotria verticillata*). The Indian cucumber-root has deep green leaves with a stem that is thin, hairy, and wiry. The large whorled pogonia has a reddish-purple stem and dark green leaves; its flower is reddish-purple.

Conservation - The small whorled pogonia was federally listed as an endangered species on September 10, 1982. It was reclassified as threatened on November 7, 1994. This was possible because at the time of reclassification 61% of the viable populations had been protected. The small whorled pogonia and its habitat continue to be threatened, directly and indirectly, by residential and commercial development. The upland habitat where it is found is seldom protected by federal or state laws unless it occurs on federally-owned property. Without voluntary landowner protection many pogonia populations have been and will be destroyed. Other threats to this species are collection by plant enthusiasts and browsing by white-tailed deer and invertebrates.

What You Can Do To Help - If you find a plant that appears to be the small whorled pogonia, take note of the location and photograph the plant, if possible. Please do not remove the plant!

U.S. Fish and Wildlife Service
Virginia Field Office
6669 Short Lane
Gloucester, Virginia 23061
(804) 693-6694
http://www.fws.gov
August 1999

Contact one of the following agencies for assistance:

Virginia Department of Agriculture and Consumer Services
Office of Plant Protection
P.O. Box 1163
Richmond, Virginia 23209
(804) 786-3515

Virginia Department of Conservation and Recreation
Division of Natural Heritage
217 Governor Street, 3rd Floor
Richmond, Virginia 23219
(804) 786-7951

U.S. Fish and Wildlife Service
Virginia Field Office
6669 Short Lane
Gloucester, Virginia 23061
(804) 693-6694

References

U.S. Fish and Wildlife Service. 1992. Small whorled pogonia (*Isotria medeoloides*) recovery plan, first revision. Newton Corner, Massachusetts.

Ware, D.M.E. 1991. Small whorled pogonia. Pages 95-97 in K. Terwilliger, ed. Virginia's Endangered Species, Proceedings of a Symposium. McDonald and Woodward Publishing Company, Blacksburg, Virginia.

Small Whorled Pogonia *(Isotria medeoloides)* Survey Contacts in Virginia

LISTED IN ALPHABETICAL ORDER

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(804) 358-4078

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Williamsburg Env. Group
3000 Easter Circle
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fax (757) 229-4507
www.wegnet.com

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(804) 264-6941 (H)

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Newport News, VA 23606
(757) 873-3702
mwallace@geo-marine.com

Dr. Donna Ware
Department of Biology
College of William and Mary
Williamsburg, VA 23187
(757) 221-2799

Inclusion of names on this list does not constitute endorsement by the U.S. Fish and Wildlife Service or any other U.S. Government agency.
July 25, 2002

W. Taylor Murphy, Jr.
Secretary of Natural Resources

Joseph H. Maroon
Director

COMMONWEALTH of VIRGINIA

DEPARTMENT OF CONSERVATION AND RECREATION

217 Governor Street
Richmond, Virginia 23219-2010
Telephone (804) 786-7951 FAX (804) 371-2674 TDD (804) 786-2121

September 19, 2002

George Barbee
Program Manager
Department of the Army
Residential Communities Initiative
Headquarters, U.S. Army Garrison, Fort Belvoir
9910 Tracy Loop, Building 766
Fort Belvoir, Virginia 22060-5843

Re: EA for the Residential Communities Initative (RCI) at Fort Belvoir

Dear Mr. Barbee:

The Department of Conservation and Recreation's Division of Natural Heritage (DCR) has searched its Biological and Conservation Data System (BCD) for occurrences of natural heritage resources from the area outlined on the submitted map. Natural heritage resources are defined as the habitat of rare, threatened, or endangered species, unique or exemplary natural communities, and significant geologic formations.

BCD documents the presence of natural heritage resources in the project area. However, due to the scope of the activity and the distance to the resources, we do not anticipate that this project will adversely impact these natural heritage resources.

Under the Memorandum of Agreement established between the Virginia Department of Agriculture and Consumer Services (VDACS) and the Department of Conservation and Recreation (DCR), DCR has the authority to report for VDACS on state-listed plant and insect species. The current activity will not affect any documented state-listed plants or insects.

New and updated information is continually added to BCD. Please contact DCR for an update on this natural heritage information if a significant amount of time passes before it is utilized.

Should you have any questions or concerns, feel free to contact me at 804-371-2708. Thank you for the opportunity to comment on this project.

Sincerely,

S. René Hypes

S. René Hypes
Project Review Coordinator

Appendix G
Economic Impact Forecast System

Economic Impact Forecast System (EIFS) Model and Outputs

Socioeconomic Impact Assessment

Socioeconomic impacts are linked through cause-and-effect relationships. Military payrolls and local procurement contribute to the economic base for the region of influence (ROI). Constructing on-post housing at Fort Belvoir will have a multiplier effect on the local and regional economy. During the construction period, direct jobs will be created, generating new income and increasing personal spending. This spending generally creates secondary jobs, increases business volume, and increases revenues for schools and other social services.

The Economic Impact Forecast System

The US Army, with the assistance of many academic and professional economists and regional scientists, developed the Economic Impact Forecast System (EIFS) to address the economic impacts of actions requiring NEPA and to measure their significance. As a result of its designed applicability, and in the interest of uniformity, EIFS should be used in NEPA assessments for RCI. The entire system is designed for the scrutiny of a populace affected by the actions being studied. The algorithms in EIFS are simple and easy to understand, but still have firm, defensible bases in regional economic theory.

EIFS is implemented as an on-line system supported by the Mobile District Corps of Engineers and U.S. Army Environmental Policy Institute (AEPI), through the Computer and Information Science Department of Clark Atlanta University. The system is available on the Internet to anyone with an approved user ID and password. The databases in EIFS are national in scope and cover the approximately 3,700 counties, parishes, and independent cities that are recognized as reporting units by federal agencies. EIFS allows the user to "define" an economic region of influence (ROI) by simply identifying the counties to be analyzed. Once the ROI is defined, the system aggregates the data, calculates "multipliers" and other variables used in the various models in EIFS, and prompts the user for input data.

The EIFS Impact Model

The basis of the EIFS analytical capabilities is the calculation of multipliers that are used to estimate the impacts resulting from Army-related changes in local expenditures and/or employment. In calculating the multipliers, EIFS uses the economic base model approach, which relies on the ratio of total economic activity to "basic" economic activity. Basic, in this context, is defined as the production or employment engaged to supply goods and services outside the ROI or by federal activities (such as military installations and their employees). According to economic base theory, the ratio of total income to basic income is measurable (as the multiplier) and sufficiently stable so that future changes in economic activity can be forecast. This technique is especially appropriate for estimating "aggregate" impacts and makes the economic base model ideal for the EA/EIS process.

The multiplier is interpreted as the total impact on the economy of the region resulting from a unit change in its basic sector; for example, a dollar increase in local expenditures due to an expansion of its military installation. EIFS estimates its multipliers using a

"location quotient" approach based on the concentration of industries within the region relative to the industrial concentrations for the nation.

After selecting the ROI, the user inputs into the model those data elements which describe the Army action: dollar volume of the construction project, changes in civilan employment, the average income of affected civilian personnel, the number of military families to move on-post, and the average income of affected military personnel. Once these are entered into the system, a projection of changes in the local economy is provided. These are projected changes in sales volume, employment, income, and population. These four "indicator" variables are used to measure and evaluate socioeconomic impacts.

The Significance of Socioeconomic Impacts

Once model projections are obtained, the Rational Threshold Value (RTV) profile allows the user to evaluate the "significance" of the impacts. This analytical tool reviews the historical trends for the defined region and develops measures of local historical fluctuations in sales volume, employment, income, and population. These evaluations identify the positive and negative changes within which a project can affect the local economy without creating a significant impact. The greatest historical changes define the boundaries that provide a basis for comparing an action's impact on the historical fluctuation in a particular area. Specifically, EIFS sets the boundaries by multiplying the maximum historical deviation of the following variables:

		Increase	Decrease
Business Volume	x	100%	75%
Personal Income	x	100%	67%
Total Employment	x	100%	67%
Total Population	x	100%	50%

These boundaries determine the amount of change that will affect an area. The percentage allowances are arbitrary, but sensible. The maximum positive historical fluctuation is allowed with expansion because economic growth is beneficial. While cases of damaging economic growth have been cited, and although the zero-growth concept is being accepted by many local planning groups, military base reductions and closures generally are more injurious to local economies than are expansions.

The major strengths of the RTV are its specificity to the region under analysis and its basis on actual historical data for the region. The EIFS impact models, in combination with the RTV, have proven successful in addressing perceived socioeconomic impacts. The EIFS model and the RTV technique for measuring the intensity of impacts have been reviewed by economic experts and have been deemed theoretically sound.

The following are the EIFS input and output data for construction and the RTV values for the ROI. These data form the basis for the socioeconomic impact analysis presented in Section 4.0.

EIFS REPORT

PROJECT NAME: Fort Belvoir RCI - OPERATIONS - IDP YEAR 1

STUDY AREA

11001 District of Columbia
24017 Charles, MD
24031 Montgomery, MD
24033 Prince George's, MD
24009 Calvert, MD
24021Frederick, MD
51013 Arlington, VA
51059 Fairfax, VA
51061 Fauquier, VA
51107 Loudoun, VA
51153 Prince William, VA
51179 Stafford, VA
51510 Alexandria, VA
51600 Fairfax, VA
51610 Falls Church, VA
51683 Manassas, VA
51685 Manassas Park, VA

FORECAST INPUT

Change In Local Expenditures	$0
Change In Civilian Employment	31
Average Income of Affected Civilian	$51,470
Percent Expected to Relocate	0
Change In Military Employment	0
Average Income of Affected Military	$0
Percent of Military Living On-post	0

FORECAST OUTPUT		**% Change**
Employment Multiplier	2.5	
Income Multiplier	2.5	
Sales Volume - Direct	$1,282,838	
Sales Volume - Induced	$1,924,258	
Sales Volume - Total	$3,207,096	0%
Income - Direct	$1,595,570	
Income - Induced)	$422,767	

Income - Total (place of work)	$2,018,337	0%
Employment - Direct	37	
Employment - Induced	8	
Employment - Total	45	0%
Local Population	0	
Local Off-base Population	0	0%

RTV SUMMARY

	Sales Volume	Income	Employment	Population
Positive RTV	11.74	11.51	3.55	1.38
Negative RTV	-4.44	-3.71	-2.76	-0.79

RTV DETAILED

SALES VOLUME

Year	Value	Adj_Value	Change	Deviation	%Deviation
1969	11051963	48297077	0	0	0
1970	12197455	50375491	2078414	-588226	-1.17
1971	13492228	53429223	3053733	387093	0.72
1972	14816392	56746780	3317557	650917	1.15
1973	16212791	58528174	1781394	-885246	-1.51
1974	17776622	57774022	-754152	-3420792	-5.92
1975	19612061	58443942	669921	-1996719	-3.42
1976	21676759	61128459	2684517	17877	0.03
1977	23988367	63329291	2200832	-465808	-0.74
1978	26476670	65132609	1803318	-863322	-1.33
1979	29395247	64963497	-169112	-2835752	-4.37
1980	32928069	63880456	-1083041	-3749681	-5.87
1981	36459772	64169198	288743	-2377897	-3.71
1982	39536963	65631357	1462159	-1204481	-1.84
1983	43020226	69262564	3631207	964567	1.39
1984	48340205	74443914	5181349	2514709	3.38
1985	53212742	79286986	4843072	2176432	2.75
1986	58162148	84916738	5629752	2963112	3.49
1987	64024057	99237285	14320547	11653907	11.74

1988	70991437	96548355	-2688930	-5355570	-5.55
1989	76691639	98932211	2383856	-282784	-0.29
1990	80673696	99228648	296436	-2370204	-2.39
1991	83643152	98698915	-529733	-3196373	-3.24
1992	88843632	101281739	2582824	-83816	-0.08
1993	93285668	103547093	2265354	-401286	-0.39
1994	97163888	104937003	1389910	-1276730	-1.22
1995	100697282	105732141	795138	-1871502	-1.77
1996	104767724	106863076	1130935	-1535705	-1.44
1997	110925566	110925566	4062490	1395850	1.26
1998	119624475	117231988	6306422	3639782	3.1
1999	130412779	125196265	7964277	5297637	4.23
2000	143687709	133629570	8433305	5766665	4.32

INCOME

Year	Value	Adj_Value	Change	Deviation	%Deviation
1969	11355369	49622961	0	0	0
1970	12637790	52194074	2571113	-439236	-0.84
1971	13973993	55337013	3142939	132590	0.24
1972	15344757	58770418	3433405	423056	0.72
1973	16850317	60829643	2059224	-951125	-1.56
1974	18613496	60493862	-335781	-3346130	-5.53
1975	20486775	61050590	556728	-2453621	-4.02
1976	22586858	63694938	2644348	-366001	-0.57
1977	24921427	65792570	2097632	-912717	-1.39
1978	27573007	67829598	2037028	-973321	-1.43
1979	30753844	67965996	136398	-2873951	-4.23
1980	34835245	67580377	-385619	-3395968	-5.03
1981	39274743	69123547	1543170	-1467179	-2.12
1982	42961200	71315591	2192043	-818306	-1.15
1983	46664568	75129955	3814365	804016	1.07
1984	52677624	81123539	5993584	2983235	3.68
1985	57907898	86282769	5159230	2148881	2.49
1986	62975034	91943552	5660783	2650434	2.88
1987	69232566	107310474	15366922	12356573	11.51
1988	76864362	104535533	-2774941	-5785290	-5.53

1989	83824257	108133288	3597755	587406	0.54
1990	88982717	109448744	1315455	-1694894	-1.55
1991	92804912	109509791	61048	-2949301	-2.69
1992	97884978	111588874	2079082	-931267	-0.83
1993	103203054	114555391	2966518	-43831	-0.04
1994	108188832	116843943	2288552	-721797	-0.62
1995	112251643	117864220	1020277	-1990072	-1.69
1996	117533618	119884288	2020068	-990281	-0.83
1997	124088389	124088389	4204101	1193752	0.96
1998	134312327	131626083	7537694	4527345	3.44
1999	144100904	138336865	6710782	3700433	2.67
2000	156939929	145954135	7617270	4606921	3.16

EMPLOYMENT

Year	Value	Change	Deviation	%Deviation
1969	1333975	0	0	0
1970	1357871	23896	-22422	-1.65
1971	1386631	28760	-17558	-1.27
1972	1422602	35971	-10347	-0.73
1973	1465959	43357	-2961	-0.2
1974	1496357	30398	-15920	-1.06
1975	1516249	19892	-26426	-1.74
1976	1542457	26208	-20110	-1.3
1977	1585099	42642	-3676	-0.23
1978	1646797	61698	15380	0.93
1979	1701766	54969	8651	0.51
1980	1731357	29591	-16727	-0.97
1981	1752664	21307	-25011	-1.43
1982	1761198	8534	-37784	-2.15
1983	1814486	53288	6970	0.38
1984	1929358	114872	68554	3.55
1985	2035960	106602	60284	2.96
1986	2143326	107366	61048	2.85
1987	2252410	109084	62766	2.79
1988	2340496	88086	41768	1.78
1989	2402235	61739	15421	0.64

1990	2420606	18371	-27947	-1.15
1991	2369336	-51270	-97588	-4.12
1992	2361252	-8084	-54402	-2.3
1993	2400591	39339	-6979	-0.29
1994	2424492	23901	-22417	-0.92
1995	2469011	44519	-1799	-0.07
1996	2495400	26389	-19929	-0.8
1997	2545420	50020	3702	0.15
1998	2604149	58729	12411	0.48
1999	2691937	87788	41470	1.54
2000	2816140	124203	77885	2.77

POPULATION

Year	Value	Change	Deviation	%Deviation
1969	2275032	0	0	0
1970	2311061	36029	-4257	-0.18
1971	2336958	25897	-14389	-0.62
1972	2389587	52629	12343	0.52
1973	2406649	17062	-23224	-0.96
1974	2413551	6902	-33384	-1.38
1975	2437740	24189	-16097	-0.66
1976	2452201	14461	-25825	-1.05
1977	2453756	1555	-38731	-1.58
1978	2476224	22468	-17818	-0.72
1979	2479131	2907	-37379	-1.51
1980	2495922	16791	-23495	-0.94
1981	2543500	47578	7292	0.29
1982	2580537	37037	-3249	-0.13
1983	2626173	45636	5350	0.2
1984	2690860	64687	24401	0.91
1985	2759737	68877	28591	1.04
1986	2837785	78048	37762	1.33
1987	2918222	80437	40151	1.38
1988	2990223	72001	31715	1.06
1989	3040972	50749	10463	0.34
1990	3065040	24068	-16218	-0.53

1991	3104655	39615	-671	-0.02
1992	3151863	47208	6922	0.22
1993	3195956	44093	3807	0.12
1994	3234199	38243	-2043	-0.06
1995	3267645	33446	-6840	-0.21
1996	3308993	41348	1062	0.03
1997	3361721	52728	12442	0.37
1998	3414741	53020	12734	0.37
1999	3488275	73534	33248	0.95
2000	3564195	75920	35634	1

****** End of Report ******

EIFS REPORT

PROJECT NAME: Fort Belvoir - CONSTRUCTION EXPENDITURES - IDP YEAR TWO (PEAK)

STUDY AREA
11001 District of Columbia
24017 Charles, MD
24031 Montgomery, MD
24033 Prince George's, MD
24009 Calvert, MD
24021Frederick, MD
51013 Arlington, VA
51059 Fairfax, VA
51061 Fauquier, VA
51107 Loudoun, VA
51153 Prince William, VA
51179 Stafford, VA
51510 Alexandria, VA
51600 Fairfax, VA
51610 Falls Church, VA
51683 Manassas, VA
51685 Manassas Park, VA

FORECAST INPUT

Change In Local Expenditures	$63,275,970
Change In Civilian Employment	0
Average Income of Affected Civilian	$0
Percent Expected to Relocate	0
Change In Military Employment	0
Average Income of Affected Military	$0
Percent of Military Living On-post	0

FORECAST OUTPUT		**% Change**
Employment Multiplier	2.5	
Income Multiplier	2.5	
Sales Volume - Direct	$37,965,580	
Sales Volume - Induced	$56,948,370	
Sales Volume - Total	$94,913,940	0.06%
Income - Direct	$8,341,194	

Income - Induced)	$12,511,790	
Income - Total(place of work)	$20,852,980	0.02%
Employment - Direct	167	
Employment - Induced	250	
Employment - Total	416	0.02%
Local Population	0	
Local Off-base Population	0	0%

RTV SUMMARY

	Sales Volume	Income	Employment	Population
Positive RTV	11.74	11.51	3.55	1.38
Negative RTV	-4.44	-3.71	-2.76	-0.79

RTV DETAILED

SALES VOLUME

Year	Value	Adj_Value	Change	Deviation	%Deviation
1969	11051963	48297077	0	0	0
1970	12197455	50375491	2078414	-588226	-1.17
1971	13492228	53429223	3053733	387093	0.72
1972	14816392	56746780	3317557	650917	1.15
1973	16212791	58528174	1781394	-885246	-1.51
1974	17776622	57774022	-754152	-3420792	-5.92
1975	19612061	58443942	669921	-1996719	-3.42
1976	21676759	61128459	2684517	17877	0.03
1977	23988367	63329291	2200832	-465808	-0.74
1978	26476670	65132609	1803318	-863322	-1.33
1979	29395247	64963497	-169112	-2835752	-4.37
1980	32928069	63880456	-1083041	-3749681	-5.87
1981	36459772	64169198	288743	-2377897	-3.71
1982	39536963	65631357	1462159	-1204481	-1.84
1983	43020226	69262564	3631207	964567	1.39
1984	48340205	74443914	5181349	2514709	3.38
1985	53212742	79286986	4843072	2176432	2.75
1986	58162148	84916738	5629752	2963112	3.49
1987	64024057	99237285	14320547	11653907	11.74
1988	70991437	96548355	-2688930	-5355570	-5.55
1989	76691639	98932211	2383856	-282784	-0.29

1990	80673696	99228648	296436	-2370204	-2.39
1991	83643152	98698915	-529733	-3196373	-3.24
1992	88843632	101281739	2582824	-83816	-0.08
1993	93285668	103547093	2265354	-401286	-0.39
1994	97163888	104937003	1389910	-1276730	-1.22
1995	100697282	105732141	795138	-1871502	-1.77
1996	104767724	106863076	1130935	-1535705	-1.44
1997	110925566	110925566	4062490	1395850	1.26
1998	119624475	117231988	6306422	3639782	3.1
1999	130412779	125196265	7964277	5297637	4.23
2000	143687709	133629570	8433305	5766665	4.32

INCOME

Year	Value	Adj_Value	Change	Deviation	%Deviation
1969	11355369	49622961	0	0	0
1970	12637790	52194074	2571113	-439236	-0.84
1971	13973993	55337013	3142939	132590	0.24
1972	15344757	58770418	3433405	423056	0.72
1973	16850317	60829643	2059224	-951125	-1.56
1974	18613496	60493862	-335781	-3346130	-5.53
1975	20486775	61050590	556728	-2453621	-4.02
1976	22586858	63694938	2644348	-366001	-0.57
1977	24921427	65792570	2097632	-912717	-1.39
1978	27573007	67829598	2037028	-973321	-1.43
1979	30753844	67965996	136398	-2873951	-4.23
1980	34835245	67580377	-385619	-3395968	-5.03
1981	39274743	69123547	1543170	-1467179	-2.12
1982	42961200	71315591	2192043	-818306	-1.15
1983	46664568	75129955	3814365	804016	1.07
1984	52677624	81123539	5993584	2983235	3.68
1985	57907898	86282769	5159230	2148881	2.49
1986	62975034	91943552	5660783	2650434	2.88
1987	69232566	107310474	15366922	12356573	11.51
1988	76864362	104535533	-2774941	-5785290	-5.53
1989	83824257	108133288	3597755	587406	0.54
1990	88982717	109448744	1315455	-1694894	-1.55

1991	92804912	109509791	61048	-2949301	-2.69
1992	97884978	111588874	2079082	-931267	-0.83
1993	103203054	114555391	2966518	-43831	-0.04
1994	108188832	116843943	2288552	-721797	-0.62
1995	112251643	117864220	1020277	-1990072	-1.69
1996	117533618	119884288	2020068	-990281	-0.83
1997	124088389	124088389	4204101	1193752	0.96
1998	134312327	131626083	7537694	4527345	3.44
1999	144100904	138336865	6710782	3700433	2.67
2000	156939929	145954135	7617270	4606921	3.16

EMPLOYMENT

Year	Value	Change	Deviation	%Deviation
1969	1333975	0	0	0
1970	1357871	23896	-22422	-1.65
1971	1386631	28760	-17558	-1.27
1972	1422602	35971	-10347	-0.73
1973	1465959	43357	-2961	-0.2
1974	1496357	30398	-15920	-1.06
1975	1516249	19892	-26426	-1.74
1976	1542457	26208	-20110	-1.3
1977	1585099	42642	-3676	-0.23
1978	1646797	61698	15380	0.93
1979	1701766	54969	8651	0.51
1980	1731357	29591	-16727	-0.97
1981	1752664	21307	-25011	-1.43
1982	1761198	8534	-37784	-2.15
1983	1814486	53288	6970	0.38
1984	1929358	114872	68554	3.55
1985	2035960	106602	60284	2.96
1986	2143326	107366	61048	2.85
1987	2252410	109084	62766	2.79
1988	2340496	88086	41768	1.78
1989	2402235	61739	15421	0.64
1990	2420606	18371	-27947	-1.15
1991	2369336	-51270	-97588	-4.12

1992	2361252	-8084	-54402	-2.3
1993	2400591	39339	-6979	-0.29
1994	2424492	23901	-22417	-0.92
1995	2469011	44519	-1799	-0.07
1996	2495400	26389	-19929	-0.8
1997	2545420	50020	3702	0.15
1998	2604149	58729	12411	0.48
1999	2691937	87788	41470	1.54
2000	2816140	124203	77885	2.77

POPULATION

Year	Value	Change	Deviation	%Deviation
1969	2275032	0	0	0
1970	2311061	36029	-4257	-0.18
1971	2336958	25897	-14389	-0.62
1972	2389587	52629	12343	0.52
1973	2406649	17062	-23224	-0.96
1974	2413551	6902	-33384	-1.38
1975	2437740	24189	-16097	-0.66
1976	2452201	14461	-25825	-1.05
1977	2453756	1555	-38731	-1.58
1978	2476224	22468	-17818	-0.72
1979	2479131	2907	-37379	-1.51
1980	2495922	16791	-23495	-0.94
1981	2543500	47578	7292	0.29
1982	2580537	37037	-3249	-0.13
1983	2626173	45636	5350	0.2
1984	2690860	64687	24401	0.91
1985	2759737	68877	28591	1.04
1986	2837785	78048	37762	1.33
1987	2918222	80437	40151	1.38
1988	2990223	72001	31715	1.06
1989	3040972	50749	10463	0.34
1990	3065040	24068	-16218	-0.53
1991	3104655	39615	-671	-0.02
1992	3151863	47208	6922	0.22

1993	3195956	44093	3807	0.12
1994	3234199	38243	-2043	-0.06
1995	3267645	33446	-6840	-0.21
1996	3308993	41348	1062	0.03
1997	3361721	52728	12442	0.37
1998	3414741	53020	12734	0.37
1999	3488275	73534	33248	0.95
2000	3564195	75920	35634	1

****** End of Report ******

Appendix H
Traffic Counts on Fort Belvoir

Table H-1
Fort Belvoir Existing Conditions
Peak Hour Turning Movement Volumes

AM Peak Hour

	NB			SB			EB			WB		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Telegraph Road/Beulah Street	6	63	64	195	232	219	311	729	4	154	344	121
Fairfax Co Pkwy/Kingman Road	24	745	318	904	772	33	3	8	19	36	18	107
Kingman Road/Beulah Street	6	1	2	6	2	3	20	426	200	33	145	30
Kingman Road/Gunston Road	141	0	4	0	0	0	0	60	374	2	67	0
Gunston Road/Gorgas Road	0	111	33	96	280	0	0	0	0	36	0	36
Gunston Road/Pohick-12th Street	6	95	49	95	161	17	128	203	227	54	19	86
Gunston Road/Abbott Road	4	227	73	37	410	12	0	1	0	89	0	54
Gunston Road/Goethals Road	5	265	19	10	399	6	0	1	4	10	3	35
Gunston Road/18th Street	0	46	2	96	173	1	0	2	0	5	0	29
Woodlawn Road/Gorgas Road	153	58	117	37	24	6	30	40	43	38	71	25
Pohick Road/Thoete Road	0	0	20	0	0	0	0	538	287	42	0	0
Route 1/Fairfax Co Pkwy	0	0	0	688	0	23	297	2154	0	0	597	844
Route 1/Backlick-Pohick	0	0	0	80	22	5	32	2024	786	17	1436	57
Route 1/Belvoir Road	154	0	113	0	0	0	0	1639	465	207	1356	0
Route 1/Woodlawn Road	0	0	0	72	0	27	68	1684	0	0	1536	132
Belvoir Road/12th Street	71	110	17	39	316	78	108	53	136	0	0	0
Belvoir Rd/18th Street	82	271	49	1	135	25	7	9	6	20	34	34
Mt Vernon Mem Hwy/Mt Vernon Road	190	400	0	0	597	111	93	0	81	0	0	0
Mt Vernon Road/Hurley Road	13	79	0	1	206	146	26	5	12	0	7	4

PM Peak Hour

	NB			SB			EB			WB		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Telegraph Road/Beulah Street	18	351	171	92	132	405	391	439	2	105	780	208
Fairfax Co Pkwy/Kingman Road	7	1236	27	166	828	3	35	26	33	266	2	837
Kingman Road/Beulah Street	159	0	41	17	0	14	14	349	10	9	572	25
Kingman Road/Gunston Road	541	0	6	0	0	0	0	50	357	9	65	0
Gunston Road/Gorgas Road	0	277	185	209	157	0	0	0	0	120	0	270
Gunston Road/Pohick-12th Street	268	146	65	109	98	212	28	87	44	26	178	89
Gunston Road/Abbott Road	1	444	57	48	266	2	7	1	1	30	2	43
Gunston Road/Goethals Road	10	515	33	10	322	2	9	18	10	29	4	17
Gunston Road/18th Street	0	96	1	16	47	2	0	1	0	1	2	177
Woodlawn Road/Gorgas Road	179	25	41	45	102	21	3	49	197	63	58	34
Pohick Road/Thoete Road	426	0	18	0	0	0	0	141	21	8	650	0
Route 1/Fairfax Co Pkwy	0	0	0	715	0	363	50	696	0	0	1481	1081
Route 1/Backlick-Pohick	1006	61	9	143	11	17	38	1247	126	25	1539	110
Route 1/Belvoir Road	177	0	262	0	0	0	0	1304	95	148	1497	0
Route 1/Woodlawn Road	0	0	0	240	0	78	78	1488	0	0	1567	185
Belvoir Road/12th Street	133	147	9	14	95	120	150	27	121	0	0	0
Belvoir Rd/18th Street	45	111	8	2	206	6	18	13	2	2	4	47
Mt Vernon Mem Hwy/Mt Vernon Road	146	561	0	0	419	66	104	0	180	0	0	0
Mt Vernon Road/Hurley Road	7	177	0	4	89	77	81	7	23	1	3	4

Table H-2
Fort Belvoir No Action Alternative - Year 2011
Peak Hour Turning Movement Volumes

AM Peak Hour

	NB			SB			EB			WB		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Telegraph Road/Beulah Street	10	85	85	250	300	285	400	935	10	200	445	155
Fairfax Co Pkwy/Kingman Road	35	955	410	1160	990	45	5	15	25	50	25	140
Kingman Road/Beulah Street	10	5	5	10	5	5	30	550	260	45	190	40
Kingman Road/Gunston Road	185	0	10	0	0	0	0	80	480	5	90	0
Gunston Road/Gorgas Road	0	145	45	125	360	0	0	0	0	50	0	50
Gunston Road/Pohick-12th Street	10	125	65	125	210	25	165	260	295	70	25	115
Gunston Road/Abbott Road	10	295	95	50	525	20	0	5	0	115	0	70
Gunston Road/Goethals Road	10	340	25	15	515	10	0	5	10	15	5	45
Gunston Road/18th Street	0	60	5	125	225	5	0	5	0	10	0	40
Woodlawn Road/Gorgas Road	200	75	150	50	35	10	40	55	60	50	95	35
Pohick Road/Thoete Road	0	0	30	0	0	0	0	690	370	55	0	0
Route 1/Fairfax Co Pkwy	0	0	0	885	0	30	385	2760	0	0	765	1085
Route 1/Backlick-Pohick	0	0	0	105	30	10	45	2595	1010	25	1840	75
Route 1/Belvoir Road	200	0	145	0	0	0	0	2100	600	265	1740	0
Route 1/Woodlawn Road	0	0	0	95	0	35	90	2160	0	0	1970	170
Belvoir Road/12th Street	95	145	25	50	405	100	140	70	175	0	0	0
Belvoir Rd/18th Street	105	350	65	5	175	35	10	15	10	30	45	45
Mt Vernon Mem Hwy/Mt Vernon Road	245	515	0	0	765	145	120	0	105	0	0	0
Mt Vernon Road/Hurley Road	20	105	0	5	265	190	35	10	20	0	10	10

PM Peak Hour

	NB			SB			EB			WB		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Telegraph Road/Beulah Street	25	450	220	120	170	520	505	565	5	135	1000	270
Fairfax Co Pkwy/Kingman Road	10	1585	35	215	1060	5	45	35	45	345	5	1075
Kingman Road/Beulah Street	205	0	55	25	0	20	20	450	15	15	735	35
Kingman Road/Gunston Road	695	0	10	0	0	0	0	65	460	15	85	0
Gunston Road/Gorgas Road	0	355	240	270	205	0	0	0	0	155	0	350
Gunston Road/Pohick-12th Street	345	190	85	140	130	275	40	115	60	35	230	115
Gunston Road/Abbott Road	5	570	75	65	345	5	10	5	5	40	5	60
Gunston Road/Goethals Road	15	660	45	15	415	5	15	25	15	40	10	25
Gunston Road/18th Street	0	125	5	25	65	5	0	5	0	5	5	230
Woodlawn Road/Gorgas Road	230	35	55	60	135	30	5	65	255	85	75	45
Pohick Road/Thoete Road	550	0	25	0	0	0	0	185	30	15	835	0
Route 1/Fairfax Co Pkwy	0	0	0	920	0	465	65	895	0	0	1900	1385
Route 1/Backlick-Pohick	1290	80	15	185	15	25	50	1600	165	35	1970	145
Route 1/Belvoir Road	230	0	340	0	0	0	0	1670	125	190	1920	0
Route 1/Woodlawn Road	0	0	0	310	0	100	100	1905	0	0	2010	240
Belvoir Road/12th Street	175	190	15	20	125	155	195	35	155	0	0	0
Belvoir Rd/18th Street	60	145	15	5	265	10	25	20	5	5	10	65
Mt Vernon Mem Hwy/Mt Vernon Road	190	720	0	0	540	85	135	0	235	0	0	0
Mt Vernon Road/Hurley Road	10	230	0	10	115	100	105	10	30	5	5	10

Table H-3
Fort Belvoir Build Alternative - Year 2011
Peak Hour Turning Movement Volumes

AM Peak Hour

	NB			SB			EB			WB		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Telegraph Road/Beulah Street	10	85	85	250	300	285	400	935	10	200	445	155
Fairfax Co Pkwy/Kingman Road	35	1050	410	1180	1085	45	5	15	60	50	25	150
Kingman Road/Beulah Street	10	5	5	10	5	5	30	550	260	45	190	40
Kingman Road/Gunston Road	195	0	10	0	0	0	0	110	615	5	135	0
Gunston Road/Gorgas Road	0	155	55	125	510	0	0	0	0	60	0	50
Gunston Road/Pohick-12th Street	10	135	65	125	215	25	325	280	295	70	25	125
Gunston Road/Abbott Road	10	305	95	50	685	20	0	5	0	115	0	70
Gunston Road/Goethals Road	10	365	25	15	670	10	0	5	10	15	5	45
Gunston Road/18th Street	0	60	10	125	225	5	0	5	0	10	0	40
Woodlawn Road/Gorgas Road	200	75	170	80	35	10	40	65	60	65	105	80
Pohick Road/Thoete Road	0	0	30	0	0	0	0	710	370	55	0	0
Route 1/Fairfax Co Pkwy	0	0	0	935	0	30	385	2775	0	0	805	1180
Route 1/Backlick-Pohick	0	0	0	105	30	10	45	2640	1030	25	1975	75
Route 1/Belvoir Road	325	0	180	0	0	0	0	2110	635	280	1750	0
Route 1/Woodlawn Road	0	0	0	105	0	40	95	2200	0	0	1990	185
Belvoir Road/12th Street	95	150	25	50	405	130	140	60	205	0	0	0
Belvoir Rd/18th Street	105	380	65	5	190	35	15	15	10	30	45	45
Mt Vernon Mem Hwy/Mt Vernon Road	250	520	0	0	770	170	150	0	130	0	0	0
Mt Vernon Road/Hurley Road	20	115	0	5	235	190	35	10	20	0	5	10

Table X-X
Fort Belvoir Build Alternative - Year 2011
Peak Hour Turning Movement Volumes

PM Peak Hour

	NB			SB			EB			WB		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Telegraph Road/Beulah Street	25	450	220	120	170	520	505	565	5	135	1000	270
Fairfax Co Pkwy/Kingman Road	10	1645	35	245	1205	5	45	35	70	345	5	1095
Kingman Road/Beulah Street	205	0	55	25	0	20	20	450	15	15	735	35
Kingman Road/Gunston Road	835	0	10	0	0	0	0	140	470	15	130	0
Gunston Road/Gorgas Road	0	495	260	270	205	0	0	0	0	165	0	350
Gunston Road/Pohick-12th Street	345	200	85	65	135	275	40	135	85	35	270	120
Gunston Road/Abbott Road	5	740	75	65	365	5	10	5	5	40	5	60
Gunston Road/Goethals Road	15	825	45	15	445	5	15	25	15	40	10	25
Gunston Road/18th Street	0	125	5	45	70	5	0	5	0	5	5	230
Woodlawn Road/Gorgas Road	230	35	90	135	135	30	5	85	255	115	85	95
Pohick Road/Thoete Road	550	0	25	0	0	0	0	230	30	15	875	0
Route 1/Fairfax Co Pkwy	0	0	0	1055	0	465	65	935	0	0	1955	1445
Route 1/Backlick-Pohick	1330	80	15	185	15	25	50	1730	210	35	2045	145
Route 1/Belvoir Road	290	0	360	0	0	0	0	1690	235	195	1935	0
Route 1/Woodlawn Road	0	0	0	330	0	110	105	1940	0	0	2020	260
Belvoir Road/12th Street	225	175	15	20	125	290	200	50	155	0	0	0
Belvoir Rd/18th Street	60	165	15	5	285	10	25	20	20	5	10	65
Mt Vernon Mem Hwy/Mt Vernon Road	220	725	0	0	545	160	165	0	250	0	0	0
Mt Vernon Road/Hurley Road	10	205	0	10	120	100	105	5	30	5	5	10